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ABSTRACT

This project was designed to prepare curriculum materials that can be used to teach general computer literacy and rudimentary programming for grades 7 and 8. The intended audience for these materials is the grade 7 and 8 teacher who is not experienced in computer literacy or programming. Materials provided include, in separate sections for the two grade levels: (1) a syllabus; (2) lesson plans and suggested exercises related to syllabus topics; and (3) supplemental materials (suggested projects/field trips, crossword puzzles and word searches, and pretests/posttests with answers). Grade 7 syllabus topics include computers in the 20th century, computer organization and operation (computer functions, computer components, and computer operation), and flowcharting (definition of a flowchart, flowchart symbols, reading/writing a flowchart). Grade 8 syllabus topics include computer organization and operation (problem-solving processes, software, components of the computer system, classifying computers), limitations of computers, and flowcharting/problem-solving (linear flowcharts, looping, subroutines). Units on programming are also provided for each grade level. Grade 7 programming topic areas include commands (PRINT, LET, INPUT), calculations, and order of operations. Grade 8 programming topic areas include alphanumeric variables, READ/DATA statements, and loops using GOTO and FOR/NEXT. Suggested exercises with answers and a quiz are provided with each unit. (JN)

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COMPUTER LITERACY

A CO-SER PROJECT OF
CORTLAND-MADISON BOCES
SUMMER 1983

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PREFACE

The purpose of this project was to prepare curriculum materials that can be used to teach general computer literacy and rudimentary programming for the seventh and eighth grade. The intended audience for these materials is the seventh and eighth grade teacher. The project was written to provide a teacher who is not experienced in computer literacy or programming with a self-learning package. Anything implied or seemingly understood in the lesson plans is fully explained in the syllabus. The quizzes, puzzles, word searches, etc... have been written so they can be copied and given to the students. Answer keys are provided at the end of the section where the particular materials are found. It is understood that a microcomputer will be available from time to time for demonstration, but most of the material can be taught without the aid of the computer. If you have continuing use of a microcomputer, we have supplied a supplemental disk with screen lessons that can be used with any APPLE computer. (Disk is explained in the next section.)

We have included a unit on programming for the seventh and eighth grade. Although this is not included in the NYS recommended syllabus, it is suggested that each teacher introduce this to his/her students. The 1982 Coser Project, HOW TO RUN A COMPUTER is an excellent guide for the

teacher who needs additional help with programming. (HOW TO RUN A COMPUTER has been referred to throughout this book as the Text.) In this field, unlike others, THE STUDENTS ROUTINELY SURPASS THEIR TEACHERS IN THEIR ABILITY TO COMPOSE PROGRAMS. The wise teacher uses capable students to aid in his/her own learning. In any event, it would be a big mistake to wait until you feel confident with programming before you introduce it to your class.

An attempt was made to write this project in such a way as to make it applicable to any microcomputer. The APPLE computer was used in our writing, but with only minor alterations, the majority of the material in the programming unit can be used on other micro's such as PET, TRS-80, ATARI, and others.

APPLE----Trademark of
APPLE Computer Company.

PET-----Trademark of
Commodore Business
Machines, Inc.

TRS-80---Trademark of
Radio Shack, Tandy
Corporation.

ATARI----Trademark of
ATARI, Inc.

HOW TO USE THE COMPUTER
LITERACY SUPPLEMENTAL DISK

This disk is to be used in teaching the lessons included in this project. It may be used in place of a blackboard or an overhead. The programs are labeled by both the subject matter and the section of the syllabus. A large color monitor is recommended for classroom use.

DIRECTIONS:

1. Locate your disk drive and open the door.
2. With your thumb on the label, label side up, slide the disk into the disk drive. DO NOT FORCE THE DISK INTO THE DRIVE OR YOU MAY DAMAGE IT!
3. Close the door to the drive.
4. Turn on the computer and the monitor. The red light on the disk drive will come on and the drive will make a noise. The computer is now reading instructions off the disk. These instructions help the computer find and save programs on the disk. The process is called 'Booting'. DO NOT TRY TO REMOVE OR INSERT A DISK WHILE THE RED LIGHT IS ON!
5. A display will appear on the screen reading:

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COMPUTER LITERACY
SUMMER 1983

Do nothing.

6. You will then see a listing of the three parts of the syllabus (called the menu.) Type in the number of the one you wish to see.

7. Now you will see another menu consisting of the individual lessons. Type in the number of the lesson you are working on.
8. After a few moments, the title of your lesson should appear across the screen.
9. Hit any key to go on to the next page or frame.
10. When you have finished the lesson the program will return to the menu.
11. In the event of an emergency, simply turn the computer off, then on again. This will 'reboot' the disk.

We recommend that you preview the lessons to check on the relevance, and the difficulty, of the material.

SUGGESTED READING

1. Billings, Karen & Moursund, David. ARE YOU COMPUTER LITERATE?. Dilithium Press, Beaverton, OR.
2. Boillat, Michel & Hora, L. Wayne. BASIC-3rd EDITION. West Publishing Co., St. Paul, MN 55165.
3. Coan, James. BASIC APPLE BASIC. Hayden Book Co., Inc., Rochelle Park, NJ.
4. Dwyer, Thomas & Kaufman, Micheal. A GUIDED TOUR OF PROGRAMMING IN BASIC. Houghton Mifflin Company, Boston, MA.
5. Graham, Neill. COMPUTERS AND COMPUTING. West Publishing Co., St. Paul MN 55165.
6. McQuigg, James & Harness, Alta. FLOWCHARTING. Houghton Mifflin Company, New York, NY.
7. Moody, Robert. THE FIRST BOOK OF MICROCOMPUTERS. Hayden Book Co., Inc., Rochelle, NJ.
8. Osborne, Adam & Bunnell, David. AN INTRODUCTION TO MICROCOMPUTERS-VOL.0. Osborne/McGraw-Hill, 630 Bancroft Way, Berkeley, CA 94710.
9. Poole, Lon with McNiff, Martin & Cook, Steven. APPLE II USER'S GUIDE. Osborne/McGraw-Hill, Berkeley, CA 94710.
10. Richman, Ellen. SPOTLIGHT ON COMPUTER LITERACY. Random House, Inc., New York, NY.
11. Shelly, Gary & Cashman, Thomas. INTRODUCTION TO COMPUTERS AND DATA PROCESSING. Anaheim Publishing Company, Brea, CA 92621.
12. Spencer, Donald. COMPUTERS IN SOCIETY. Hayden Book Co., Inc., Rochelle, NJ.
13. Spencer, Donald. PROBLEMS FOR COMPUTER SOLUTION. Hayden Book Co., Inc., Rochelle, NJ.
14. Willis, Jerry & Miller, Merl. COMPUTERS FOR EVERYBODY. Dilithium Press, Beaverton, OR.

SYLLABUS

GRADE 7

I. COMPUTERS IN THE TWENTIETH CENTURY

A. Applications in the home

There are many varied uses for computers in the home. The one most people are familiar with is entertainment. Just about everyone has played at least one video, or computer game. However, they have other entertaining uses such as composing music and drawing pictures. Computer programming can also be developed into a hobby.

Budgeting is an excellent practical use for computers in the home. It will perform tasks, such as balancing a checkbook, quickly and accurately. It can also keep tax records and watch your investments.

Database systems can keep large amounts of information with the advantage of easy access. Think of doing Christmas cards or wedding invitations with a program that will print mailing labels. The system is also capable of storing telephone numbers, appointments, recipes, or any other types of lists you may wish to store.

On a diet? Use the computer to count your calories, plan your diet, and monitor your exercise.

Other uses include word processing to make your correspondence easier, monitoring the temperature in your home, controlling your appliances, and connecting you with your bank or store to speed up transactions.

B. Applications in Business

There are many interesting uses of the computer in business. A machine controlled by a computer in the auto industry transforms rough metal castings and other components into finished auto engines. A medical student at the University of Illinois Medical Center in Chicago can practice his skill in diagnosing and treating on a "computer patient." A producer in Hollywood can take a show with many small segments, such as HEE HAW or BENNY HILL and, with the help of a computer, piece the segments together in a practical, enjoyable format.

One of the most useful applications of the computer is word processing. A word processor can make the job of a secretary much easier by editing with simple commands instead of a big eraser. Filing is another task that computers have taken over, much to the joy of secretaries. Police, hospitals, telephone companies, and insurance agencies, to name a few, can store and retrieve information much easier by computer.

C. Applications in the School

The computer has an application for every room in the school building. A program can be found or made for almost any situation. With the help of your computer coordinator and/or students you may be able to develop programs to meet your classroom needs.

Computer assisted instruction (CAI) is prepared software that can be used to teach a lesson or reinforce a concept that has already been taught in the classroom. Most students find it more enjoyable to work with the computer than the textbook or workbook.

Computer programming is taught at all levels in the schools.

This is the same as teaching a new language course in the school.

Many programs are used for classroom management such as keeping track of grades, attendance, inventory, etc.

Administrators, guidance counselors, and secretaries use the computer for numerous functions such as word processing, record keeping, mailing labels and general information.

II. COMPUTER ORGANIZATION AND OPERATION

A. Functions of the computer

1. Input is the way in which the outside world communicates with the computer. There are two kinds of input: programs and data. By using an input device, the computer user is able to input programs and data into the computer, which are then processed by the CPU.

2. To understand how a computer can solve problems, we must look at the exact processing which takes place when you run a program. A program is a set of instructions that tells the computer what to do. Instructions are acted on by the computer one at a time. These instructions can tell the computer to get information from the user (input), do calculations, compare information, or give information back to the user (output).

3. Output is the information, or results, generated by the computer during the running of a program. In other words, it communicates information from the computer to the programmer.

The computer output, whether it is on a monitor or a printer, will show several things. First, you may see a listing of the program. Secondly, when running the program, the computer will indicate any errors that have occurred in the writing of the program. Lastly, when all the errors have been corrected, the computer will show the results of the program.

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B. Components of the Computer

1. The input unit of a computer system feeds information from the outside world into the computer. This information includes both data and instructions (programs). Computers are capable of reading information recorded in several different ways.

A keyboard can be used to send information directly to the computer's memory. This is the most common input device currently in use. The information being recorded is usually displayed on a monitor or TV.

Information can also first be recorded on disks, punched cards, paper tape, or magnetic tape (cassettes) and then read into the computer's memory.

A light pen is another type of input device. It looks like a pen and is connected to the computer by a cable. It senses light on the computer screen or graphics tablet and feeds the information back to the computer.

Many programs, especially game programs, require information to be sent to the computer by means of a joystick or paddles. These input devices can be attached to the computer by a cable when needed.

2. A Central Processing Unit (CPU) is a small piece of silicon called a Microprocessor Chip. This chip contains the electronic logic networks called circuits which interpret directions to the computer. It performs input/output operations of the computing system and any necessary calculations. The computer only understands directions that are coded in blocks of eight binary digits called bytes. You don't have to give instructions in

binary code, of course. The computer has a special program called an interpreter that translates your instructions into a binary code the computer can understand.¹

3. Computer memory is typically measured in units called bytes. Each byte of memory can hold one character or a similar amount of data. Depending on the number of chips, your computer has anywhere from 4096 to 65,536 bytes of memory. This is usually stated 4K to 64K, where K represents 1,024 bytes. The amount of memory determines how much you can do. Memory is stored in ROM and RAM chips or external sources such as disks.

Read-only memory (ROM) chips are located on the main board of the computer. The contents of the ROM chips never change even when the computer is turned off. ROM chips contain the language programs that give your computer its unique identity and enable it to understand and respond appropriately to the instructions you type in at the keyboard. For example, when you enter the symbol * the computer understands to multiply.

Read/write memory (also called Random-access memory or RAM) chips are located on the main board of the computer. The contents of the RAM chips do change and, unless saved on a storage device, disappear when the computer is turned off. The program in read/write memory determines the task the computer is currently applied to.

Storage devices enable you to save memory that would normally be lost when the power is turned off. Examples of storage devices

¹ Binary Code is a number system that uses the digits 0 and 1 as opposed to our regular system of using digits 0,1,2,...,8,9.

are disks and cassettes (See Text p. 13-16).

The programmer can store information quickly and easily by using a disk drive. The disk is capable of storing any number of programs depending upon their size.

The programmer can store information on a cassette tape by using a cassette recorder. This is much slower and more cumbersome than using a disk drive.

4. There are many types of output devices used depending on the computer system. However, the two types you will be using are the MONITOR and the PRINTER.

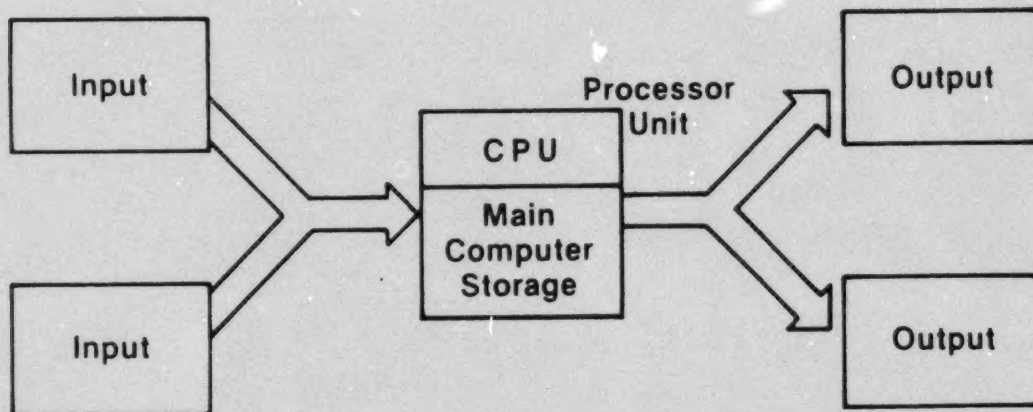
The monitor looks like a television -- without the channel knob. Its technical name is the CRT, or cathode ray tube. The monitor displays the computer output on the screen. This output may include anything you ask the computer for, (i.e. a listing of the program, program results, or data).

This output device prints at least 80 standard letters, numbers, and symbols per line at one time. The printed paper is sometimes known as HARD COPY. Through the use of the printer, the computer can print out a hard copy of the program, the program results, or anything else the programmer may wish to have printed.

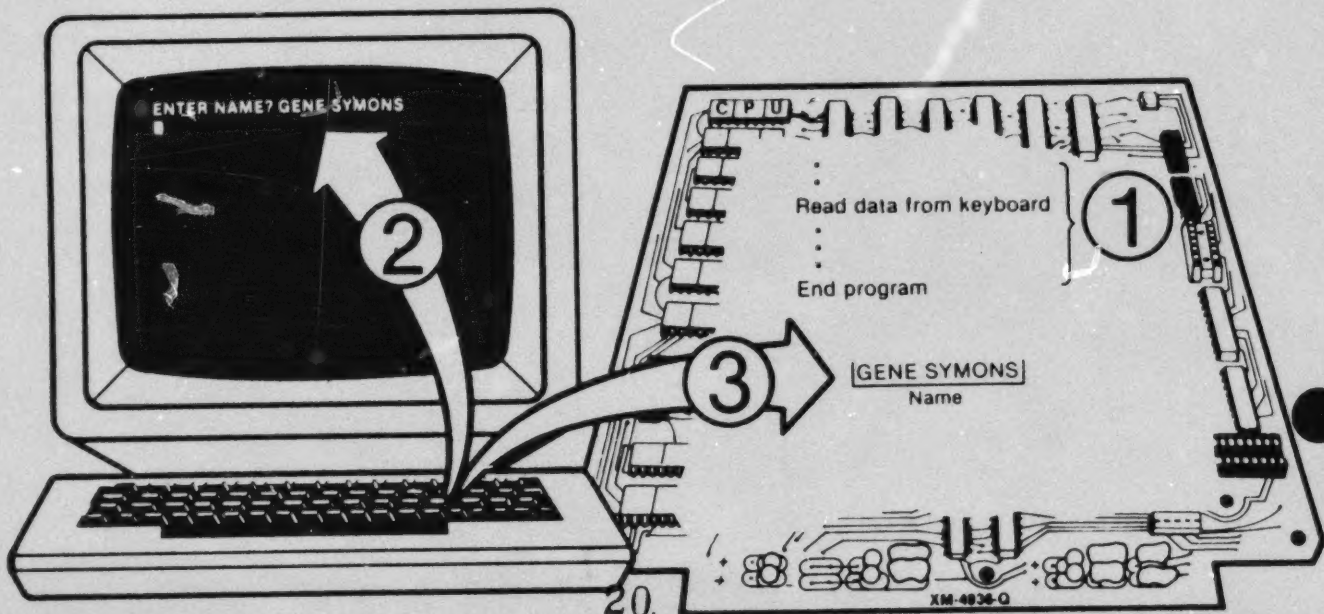
Both the printer and the monitor receive information from the Central Processing Unit. The output devices make it possible for people and machines to make use of that information.

C. How Computers Work

Although the computer is a very powerful machine, the interaction between its component parts can be simply diagrammed as follows:

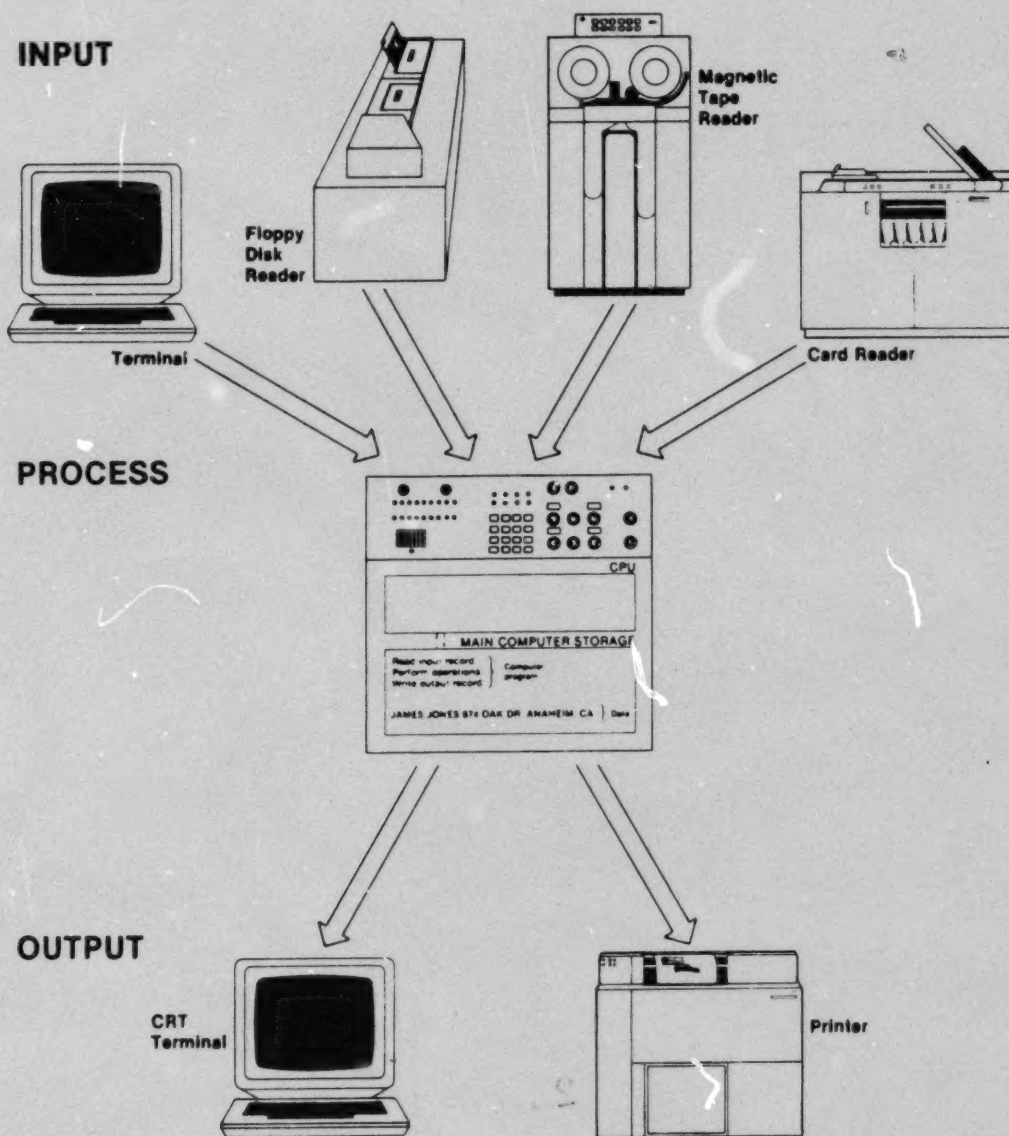


Programs and data are first transferred from the keyboard, or other input device, to the main computer storage during the input operation.

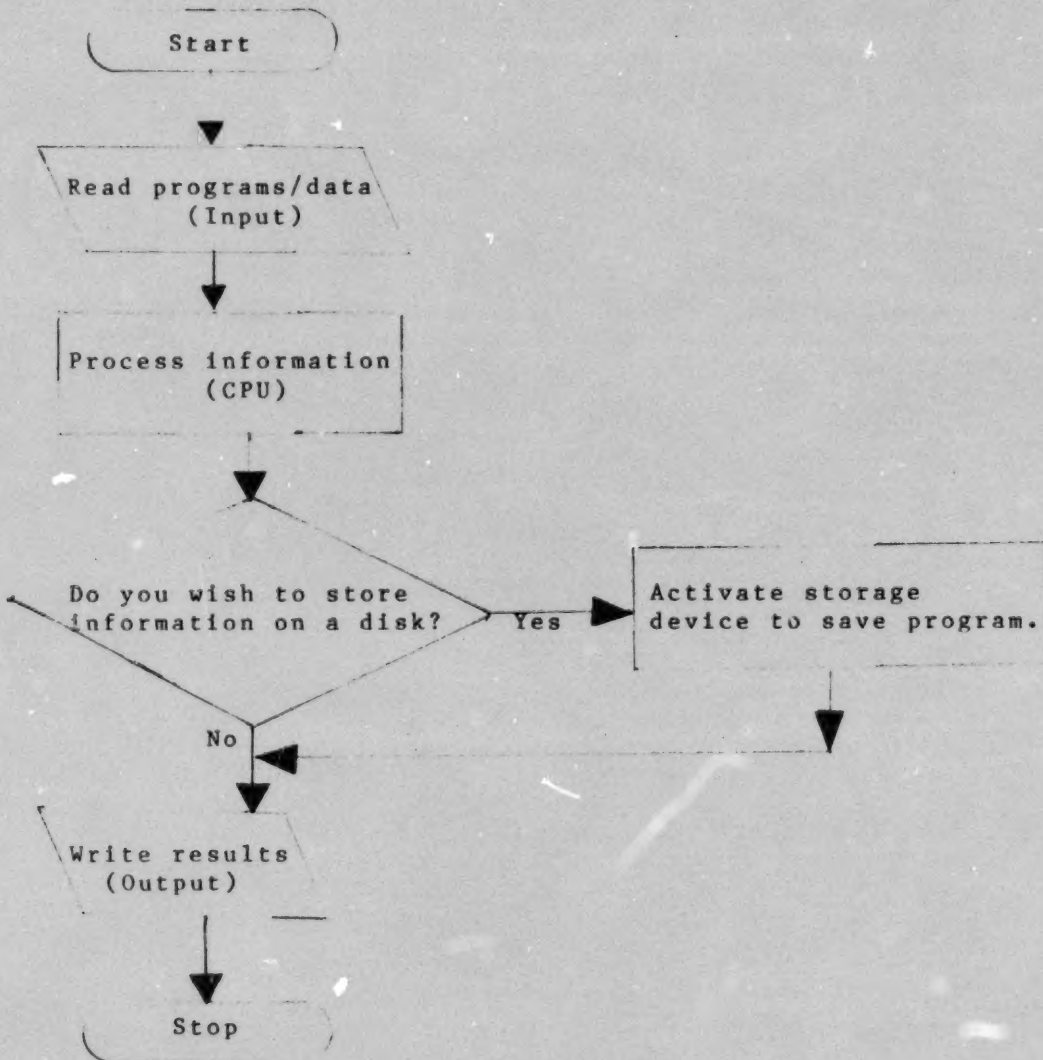


When a program or data is placed in main computer storage, it is acted upon by the CPU. The program instructions are executed and the data is processed. The program and data may be saved on some auxiliary storage device such as a disk or cassette.

The program and data are now transferred from main computer storage to the monitor or printer so that the output may be seen.



The computing process is shown in the following flowchart.
Flowcharts will be explained in detail in a later unit.



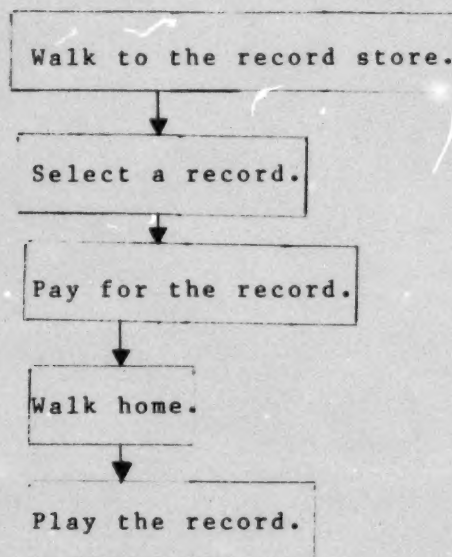
III. FLOWCHARTING

A. Definition

A flowchart is a representation, using standard symbols, of instructions for performing a task. A flowchart is like a roadmap. It can be used to plan how to solve a problem. Properly prepared flowcharts can show the steps that are used in solving the problem.

Without realizing it, people often use principles of flowcharting in their thinking. For example, suppose that you want to buy a record after school today. Your thinking might go as follows:

Example 1



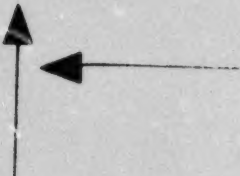
This may seem like a very simple problem but the thinking involves some of the principles of flowcharting.

When making a flowchart, two things are very important. First, every step, no matter how trivial, must be listed. Second,

the steps must be listed in the correct order. Thus, a flowchart is not only a representation of instructions using standard symbols, but one that shows every step and the proper order for solving the problem.

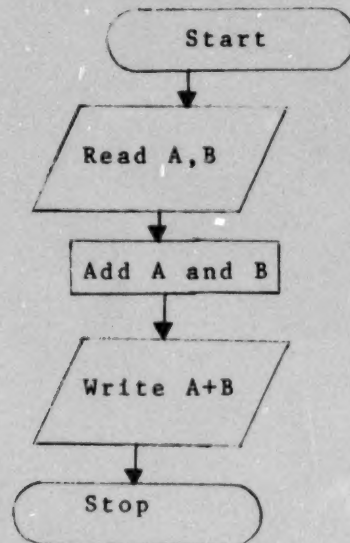
B. Flowchart Symbols

Flowchart symbols are standard so that everyone that knows the symbols can read the same flowchart. They are usually simple shapes such as ovals, quadrilaterals, and arrows. The symbols you need to know are:

SYMBOL	MEANING
	Beginning or ending.
	Instructions to be followed.
	Putting in (input) data or Getting out (output) of results. Read is used in this box for input and Write is used in this box for output.
	A decision that must be answered by yes or no. The answer to this decision will determine which step is done next.
	Arrows indicate which symbol is the next step. They show the direction of flow for solving the problem.

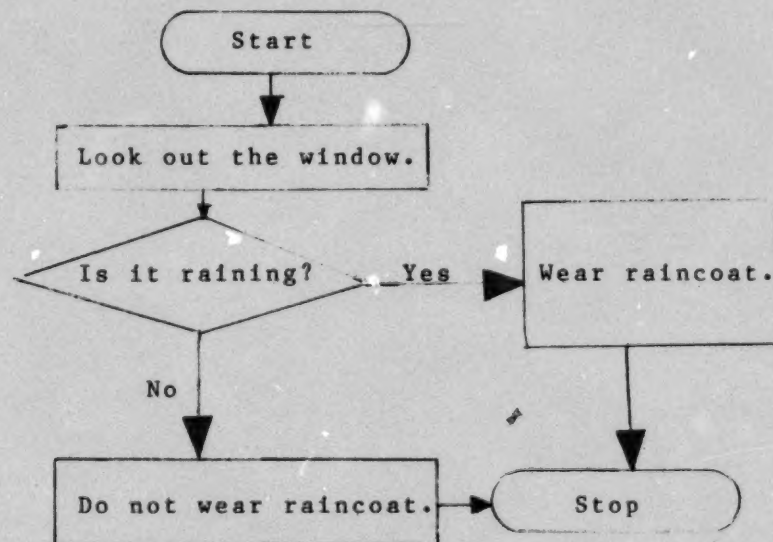
Note the use of these symbols in the next two examples.

Example 2



This is a flowchart for adding any two numbers. The problem begins and any two numbers are selected (input) which are labeled A and B. The sum of A and B is then calculated. Finally, this answer is obtained (output) and the problem ends.

Example 3

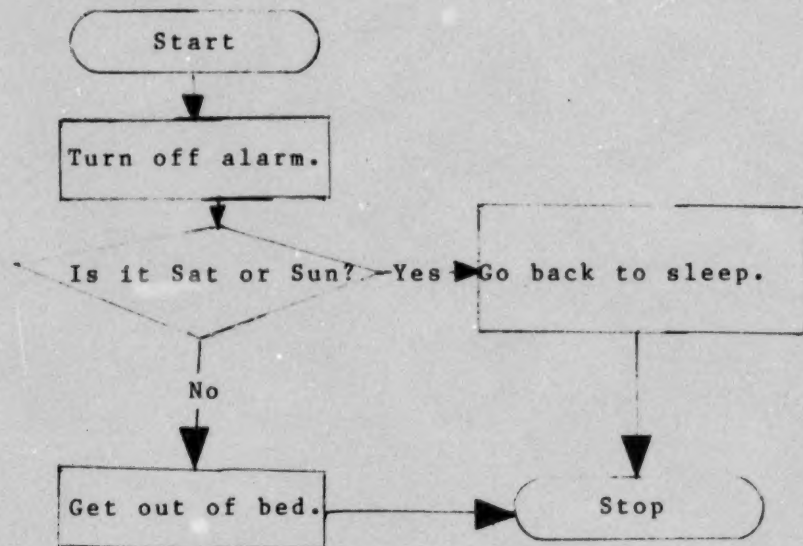


This is a flowchart for determining whether or not to wear a raincoat. The problem begins and the first step is to look out the window. This is followed by a decision. Is it raining? If the answer is yes then the instruction is to wear a raincoat and the problem ends. A no answer means an instruction to not wear a raincoat and the problem ends.

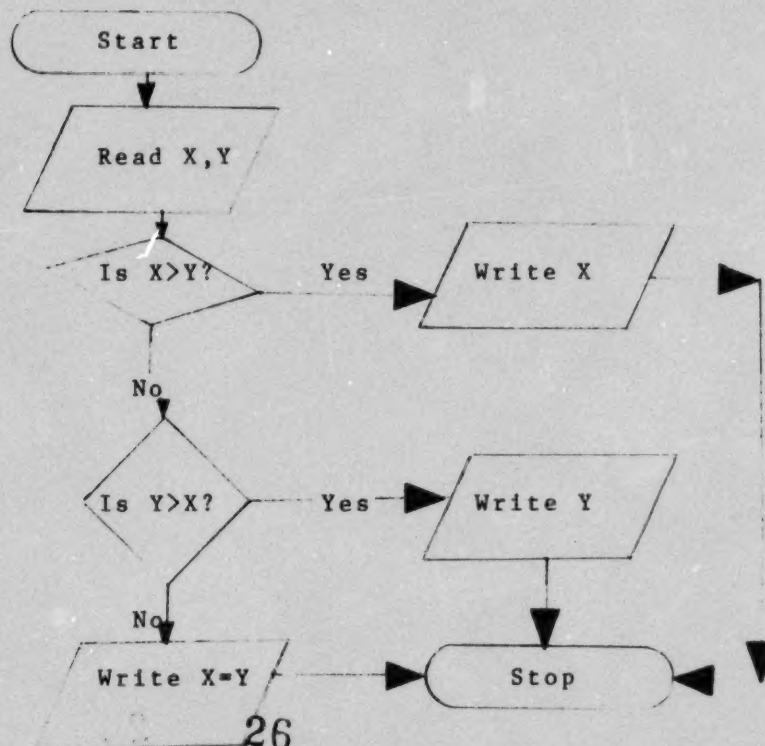
C. Reading a Flowchart

You should be able to read a simple flowchart. A sentence or two can be used to describe the problem in the next two flowcharts.

Example 4



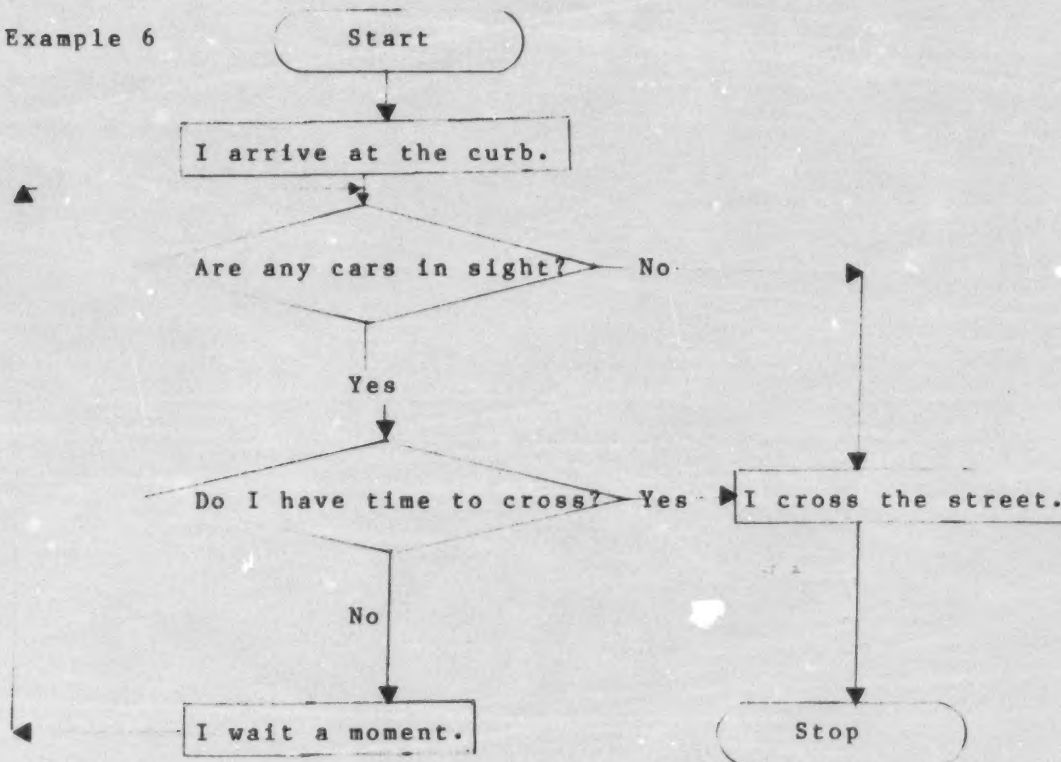
Example 5



In Example 4, the problem is deciding whether to get out of bed or not after the alarm has rung. You will go back to bed if it is Saturday or Sunday and get up if it is a weekday. The problem in Example 5 is finding which of two numbers is the largest. You must determine if the first number is greater than the second, if the second number is greater than the first, or if they are equal.

Here is a more complicated flowchart.

Example 6



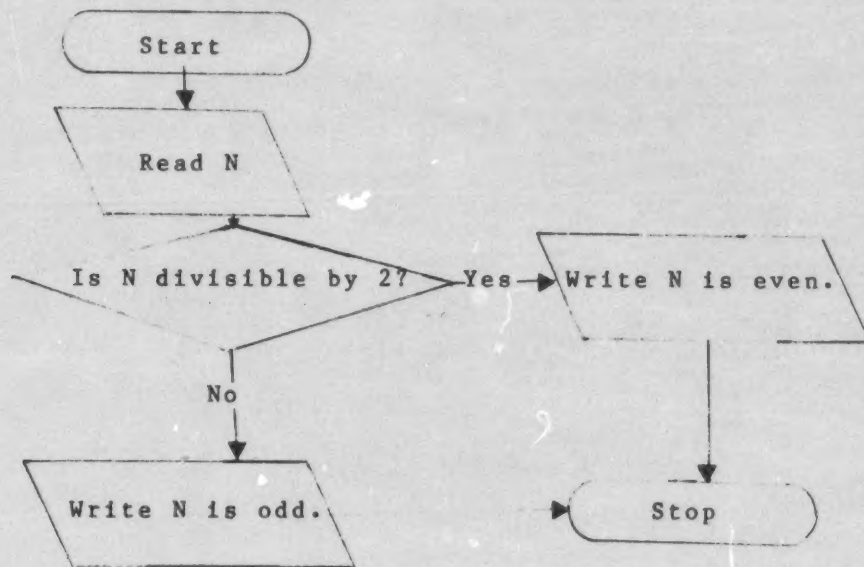
This flowchart is for crossing a street that does not have a stoplight. You must decide if there are any cars in sight and, if there are, do you have time to cross. Notice how the arrow brings the problem back to the first decision if the problem goes to the step of 'I wait a moment'.

D. Writing a Flowchart

You should now be able to write a simple flowchart. A flowchart may be written to determine if a number is even or odd.

There are several ways to do this. One is as follows:

Example 7

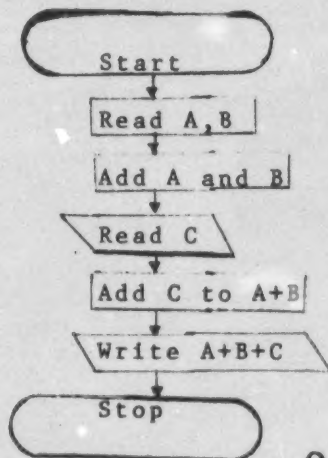


A program may be written that will add any three numbers.

(Remember that you may only add two numbers at a time.)

One way this may be done is as follows:

Example 8

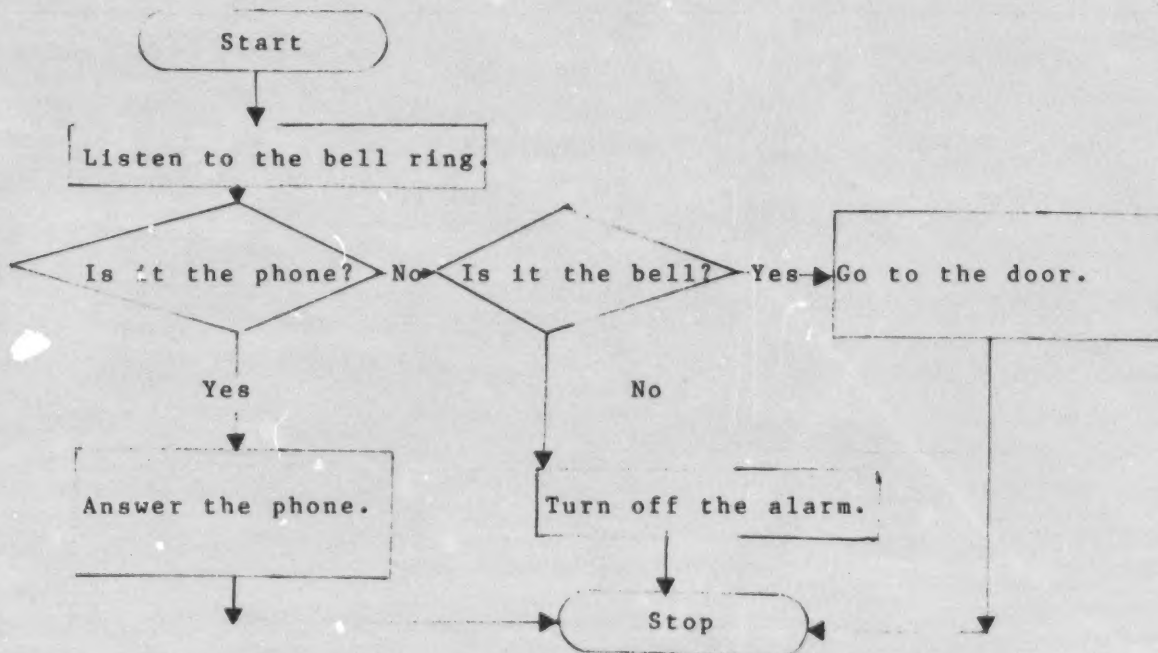


In Example 8, the three numbers were called A, B, and C. They could be called anything.

We now try a harder problem. A flowchart may be written for the following. You are in a house that has an alarm clock, a telephone, and a doorbell. One of them rings. What do you do?

Below is a sample solution.

Example 9



LESSON PLANS
AND
SUGGESTED
EXERCISES

GRADE 7

LESSON PLAN (1 TO 3 DAYS)

GRADE 7 - I. COMPUTERS IN THE TWENTIETH CENTURY

- A. Applications in the home
- B. Applications in business
- C. Applications in the school

OBJECTIVES:

1. The student will be able to identify uses of the computer in the home.
2. The student will be able to identify uses of the computer in business.
3. The student will be able to identify uses of the computer in the school.

MATERIALS NEEDED:

Magazines
Newspapers
Graph paper

LESSON FORMAT:

(One lesson format will be provided for applications in the home. This format can be modified to be used with applications in business and applications in the school.)

1. Have students generate ideas about how computers can be used in the home.
2. Record this information.
3. Supplement student suggestions with other applications if necessary.

4. Discuss home computer applications with the students.
5. Select one or more of the SUGGESTED EXERCISES for the students to complete.

SUGGESTED EXERCISES:

1. Interview local families that use a computer in their home. Find out what the computer is used for, how much time per week is spent on each activity, and if there are any drawbacks to having a computer in the home. (This may also be done with local businesses and/or schools.)
2. Graph the results from exercise 1.
3. Bring in newspaper or magazine clippings that demonstrate how computers are being used in the home. These clippings may be arranged on a bulletin board if desired.
4. Design a home (or room) of the future that makes use of a computer. Be creative!
5. Select several careers and determine what applications computers would have in each career.

LESSON PLAN (1 TO 3 DAYS)

GRADE 7 - II. COMPUTER ORGANIZATION AND OPERATION

A. Functions of the computer

B. Components of the computer

C. How computers work

OBJECTIVES:

1. The student will be able to define input, output, and process.
2. The student will be able to name three types of input units and two types of output units.
3. The student will be able to describe a CPU and list two of its functions.
4. The student will be able to differentiate between Read-only memory and Random-access memory.
5. The student will be able to name two types of secondary storage devices.
6. The student will be able to describe and diagram the interaction between components of a computer.

MATERIALS NEEDED:

Text

Microcomputer (where possible)

3 x 5 cards

Magazines

LESSON FORMAT:

(This lesson format may be broken down to cover anywhere from 1 to 3 days depending on the ability of the students and the depth of coverage.)

1. Display the microcomputer in the room so that all students may have the opportunity to observe it or, make a bulletin board display of different types of computers and computer devices.
2. Discuss input and output. Have students generate possible input and output devices from looking at the microcomputer. Supplement with other devices.
3. Discuss CPU and its functions. Show the students the CPU of the microcomputer.
4. Discuss memory and its functions. List functions of Read-only memory versus Random-access memory.
5. Discuss the need for secondary storage and types of secondary storage devices.
6. Have students read Text, p. 13-17.
7. Where possible, run a short program to show input and output in use. Have students describe the interaction between the components of the computer.

Example program

```
10 PRINT "WHAT IS YOUR NAME?"
20 INPUT N$
30 PRINT "HELLO ";N$
40 PRINT "PLEASED TO MEET YOU!"
50 END
```

8. Select one or more of the suggested exercises.

SUGGESTED EXERCISES

1. Crossword puzzle. (included)
2. Word search. (included)
3. Have students write a short paragraph describing what happens to a certain type of input after it entered.
4. Make a display of input and output devices, and how they relate to each other through the CPU.
5. Password game.

Materials:

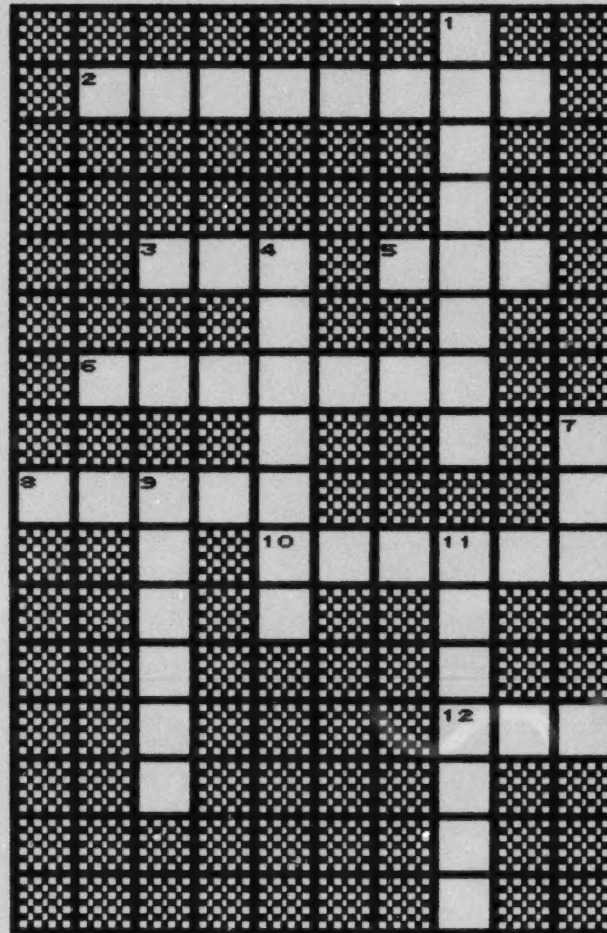
Two sets of 3 x 5 cards with the following words: (one word per card)

printer	CPU	lightpen	monitor	keyboard	paddles
ROM	RAM	disk	input	joystick	cassette tape
output	process	CRT	hard copy		

Directions:

1. Divide students into two teams.
2. The first member of each team will be giving one word clues to their teams to help them guess their word. They may not use part of the word or the word itself as a clue.
3. The clues are given one at a time to each team. Team members must raise their hands to answer.
4. If the right answer is guessed, the team scores 50 points and everyone goes on to the next word. If the wrong answer is guessed, the word passes to the other team and they are allowed another clue. Each time the word passes to another team, the value of the word drops ten points.
5. The team with the most points at the end wins.

COMPUTER OPERATION



ACROSS CLUES

2. Senses light on a computer screen or graphics tablet.
3. Unless saved, disappears when the computer is turned off.
5. Memory that never changes.
6. Output device that produces paper copies.
8. Way in which the outside world communicates with the computer.
10. Information, or results, generated by the computer during the running of a program.
12. Microprocessor chip that interprets instructions to the computer.

DOWN CLUES

1. Most commonly used input device.
4. Displays computer output on a screen.
7. Technical name for monitor.
9. Type of input device used for games.
11. CPUs _____ information during the running of a program.

COMPUTER ORGANIZATION & OPERATION

X D S E P L X A Y U R M U S U Q N S A X
 R V A F B O O E Z Z H R X Z E N K J H A
 G W J D U C A T H O D E R A Y T U B E A
 J L D H T E Z B H F J L K L X T Y C N T
 D Y D U E P A T E T T E S S A C B B P A
 T B P P I U E Q Z W D B I N A R Y P R D
 X N O M I M M J T J S H B U S I R A O I
 I M I C R O C O M P U T E R K O M S G B
 W F Z H N Y P O C D R A H R C J A O R I
 N N P I B S B C L D Q X E E I Q R L A C
 Q O T W E C F H Q W C T S U T R C G M P
 A O Y L J X R W F Y N S B E S K E R D S
 R L D I C F P L T I D C H O Y R N I A Y
 C U S Q L A I U R M I U P C O R S T Y Z
 K L M S D G P P V J S I U A J H Q H B K
 Q K Z D H T R N M T K X R I H T K P I S
 V D L T U J G O D B P V E M V A Z L V I
 J E P O I H Y D M D D R A O B Y E K S W
 S E P I X E M Q L N Z P W Y C U F C L A
 N W S T O R A G E D E V I C E S P Q K I

THERE ARE 22 WORDS HERE - CAN YOU
FIND THEM?

HERE ARE THE WORDS TO LOOK FOR:

BINARY	BYTES
CASSETTE TAPE	CATHODE RAY TUBE
CPU	DATA
DISK	HARDCOPY
INPUT	JOYSTICKS
KEYBOARD	LIGHTPEN
MICROCOMPUTER	MONITOR
OUTPUT	PADDLES
PRINTER	PROCESS
PROGRAM	RAM
ROM	STORAGE DEVICES

LESSON PLAN (2 TO 4 DAYS)
GRADE 7 - III. FLOWCHARTING

- A. Introduction
- B. Symbols
- C. Reading a flowchart
- D. Writing a flowchart

OBJECTIVES:

1. The student will be able to define what a flowchart is and how it can be used.
2. The student will be able to draw the basic symbols of flowcharting and state what each symbol means.
3. When presented with a flowchart, the student will be able to read the flowchart and summarize the problem being solved.
4. The student will be able to write a flowchart to solve a given problem.

MATERIALS NEEDED:

Microcomputer (if possible)
Computer Literacy Supplemental Disk
Activity sheets

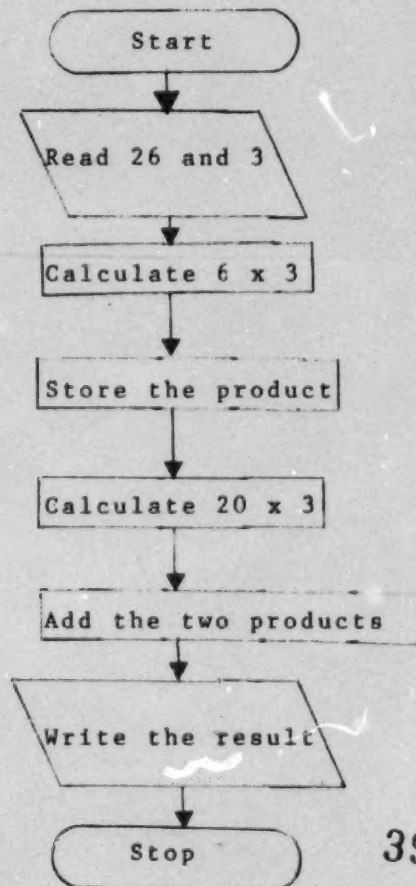
LESSON FORMAT:

1. Briefly discuss the human thought process and the logical series of steps that compose it.
2. Define a flowchart. You may run the FLOWCHART program found on the disk on a large monitor for a classroom presentation.
3. Show how the thought process and flowcharting are related.
4. Present the symbols used in flowcharting and the meaning of

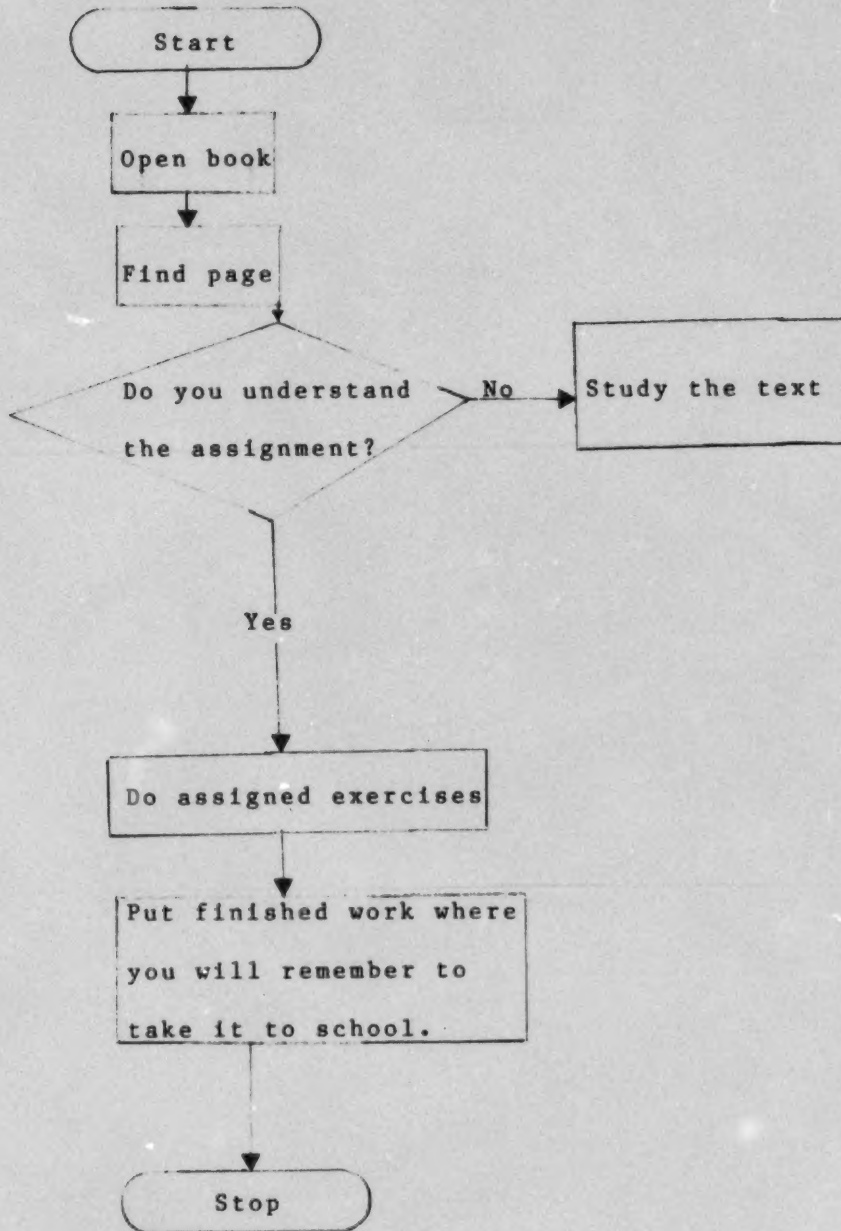
- each symbol to the students.
5. Give several sample flowcharts to the class and work through each example step by step. (See SAMPLE FLOWCHARTS activity sheet.)
 6. Use Activity Sheets #1 - 3 for practice in inserting the proper flowcharting symbols in a flowchart.
 7. Distribute several flowcharts to be read. The students should be able to state the problems that the flowcharts are being used to solve. (See SUGGESTED EXERCISES #1 - 3.)
 8. Give the students several problems to solve by writing a flowchart. (See SUGGESTED EXERCISES #4 - 8.)

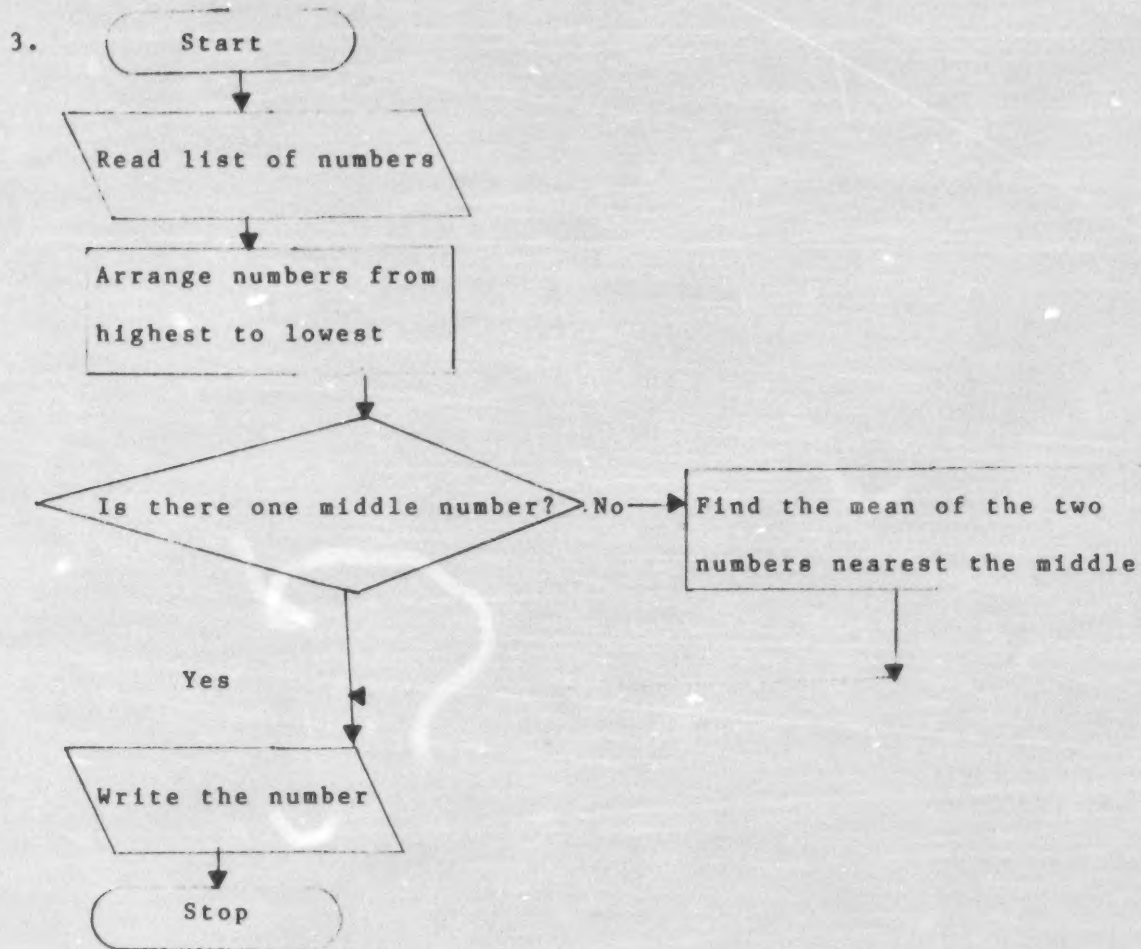
SUGGESTED EXERCISES:

1.



2.





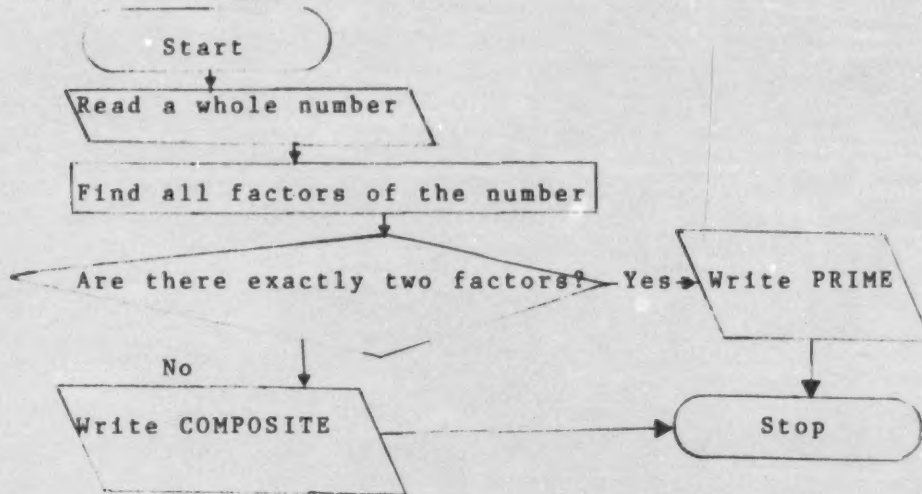
4. Write a flowchart that will calculate the area of a rectangle ($\text{Area} = \text{Length} \times \text{Width}$) by reading the length and width.
5. Write a flowchart that will calculate the interest to be paid on a loan ($\text{Interest} = \text{Principle} \times \text{Rate} \times \text{Time}$) by reading the amount of the loan (principle), the percent of the loan (rate), and the time to pay back the loan in years.
6. Write a flowchart that will calculate the average of any four numbers.

7. Write a flowchart that will tell if a triangle is equilateral (all sides the same length), isosceles (two sides the same length), or scalene (no sides the same length) by reading the three sides A, B, and C.

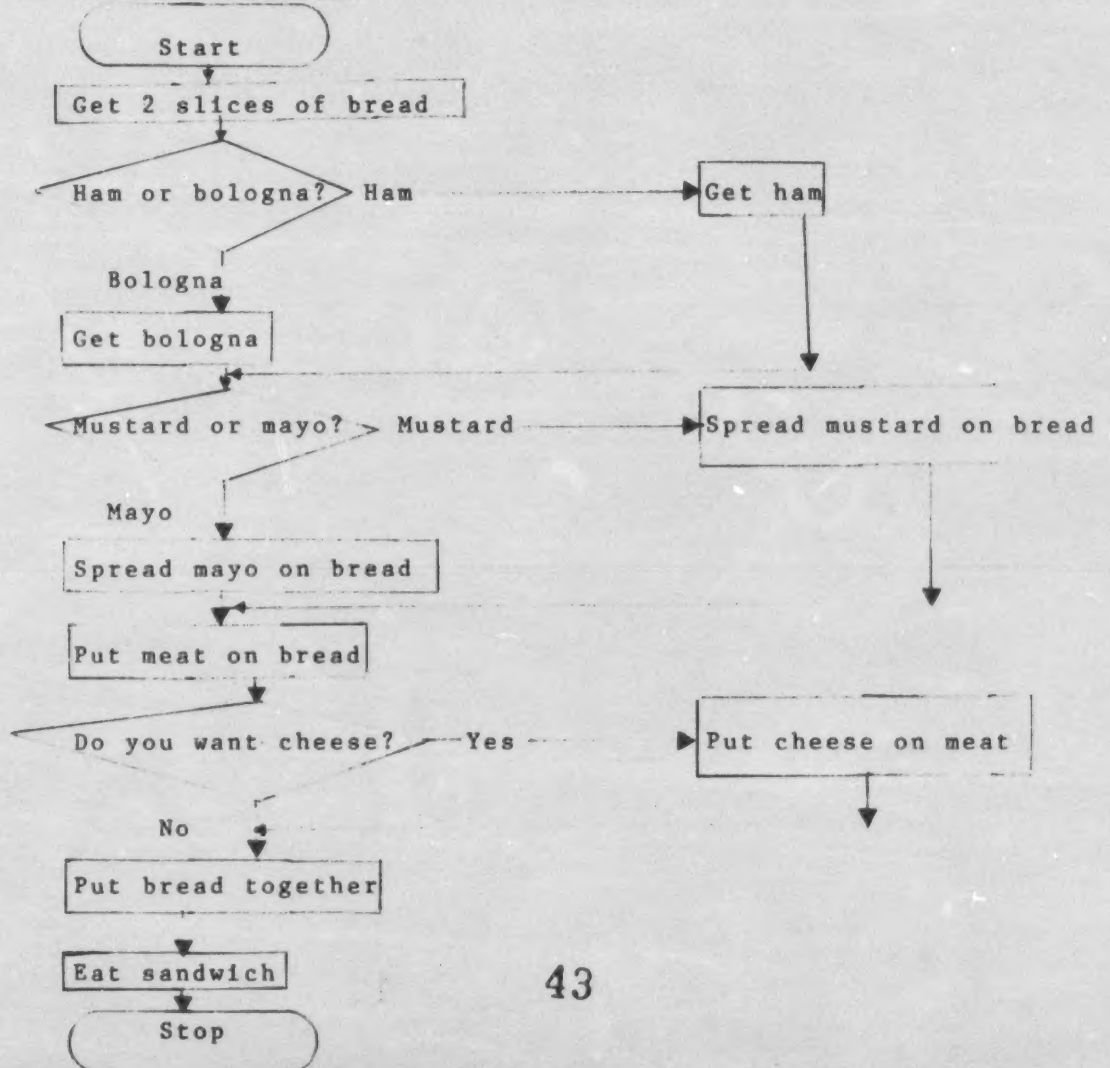
8. John has three extra tickets to a ballgame. He wants to invite 3 of his 5 best friends: Al, Bob, Carl, Ed, and Dave. If the game is on Sunday, Bob and Dave cannot go and if the game is on any other day, Al cannot go. Carl and Dave do not like each other, which means that John will not invite both together. Write a flowchart to show John the different combinations of friends he can invite.

SAMPLE FLOWCHARTS

1. PRIME NUMBERS



2. MAKING A SANDWICH



ACTIVITY SHEET #1

NAME _____

1. Start

Read temperature in Celsius

Does temp. = 0? Yes

Write FREEZING

Stop

No

Is temp. < 0? Yes

Write BITING COLD

No

Write COOL TO HOT

ACTIVITY SHEET #2

NAME _____

2. Start

Read fraction

Calculate factors of numerator

Calculate factors of denominator

Do the numerator and denominator
have a common factor > 1 ?

No

Yes

Divide numerator and denominator
by the greatest common factor

Write fraction
in lowest terms

Stop

ACTIVITY SHEET #3

NAME _____

3. Start

Pick up phone

Dial the number

Is the line busy? Yes

No

Does someone answer? No

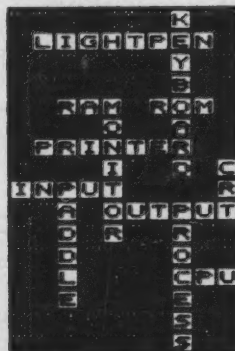
Yes

Talk on phone

Hang up phone

Stop

ANSWERS: COMPUTER OPERATION



COMPUTER ORGANIZATION AND OPERATION

[illegible]

SUPPLEMENT

GRADE 7

GRADE 7 - PROJECTS AND FIELD TRIPS

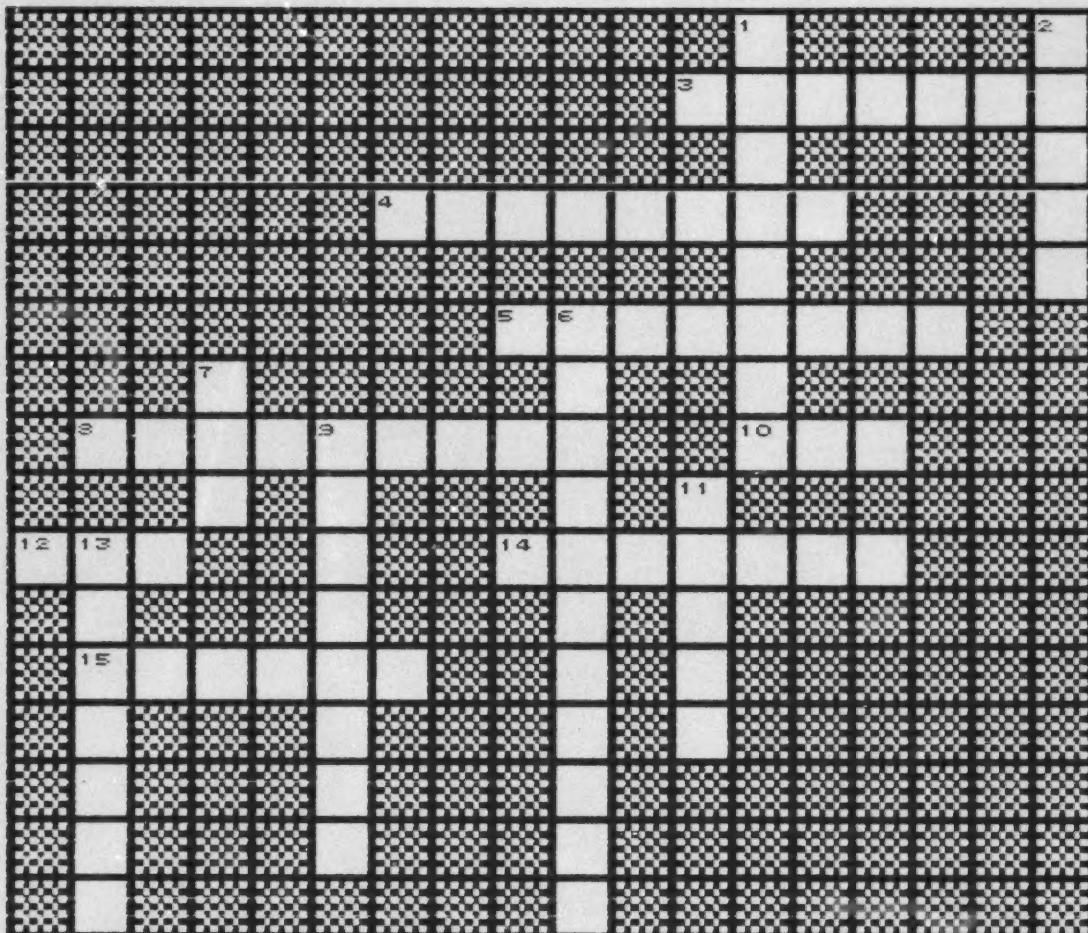
To be used with part I of the seventh grade syllabus:

1. Collect newspaper and magazine clippings that describe computer uses. Note TV items also. How are the uses of computers changing from day to day?
2. Go to a local shopping center or mall and determine how many businesses use computers. Do any of the cash registers have microcomputers inside? Do any businesses use Universal Product Code scanners? Bar-code scanners? Time sharing terminals? If you find a code reader, ask the teller how it works. For instance, how do you tell if it has read the code? How do you know if it has not read the code? What do you do if it is not reading the code at all?
3. Check into computer-related careers in the counseling center in your school. Have different individuals report on various careers.
4. Obtain a newspaper from one or more cities. Read the want ads for computer positions. How many ads are there? What types of positions are advertised? Compare the requirements and the salaries for various occupations.
5. Visit various businesses that use the following:
 - a. computerized methods of manufacturing
 - b. computerized inventory
 - c. word processing

To be used with part II of the seventh grade syllabus:

1. Visit a local arcade and examine the types of computer, video games. What do they have in common? What kind of input and output devices do they have? What type of format? Are they mostly target shooting, car racing, or what?
2. Visit a computer store. Tell the salesman that you are making a report on the kinds of computers and computer equipment available. Ask him/her to show you the various types of computers and peripheral devices. Ask to see the CPU. How many computers use the same CPU?

LIT (7)



ACROSS CLUES

3. Displays computer output and/or input.
4. Printed copy of computer output.
5. An input device that senses light on the computer screen or graphics tablet.
8. A representation of instructions for performing a task.
10. Random Access Memory (abbrev.).
12. The unit that interprets directions to the computer.
14. A device that prints computer output on paper.
15. Information the computer gives to you.

DOWN CLUES

1. A problem solving device.
2. Something cars and disks do.
6. Translates instructions into a binary code the computer can understand.
7. Memory that never changes.
9. Electronic logic networks.
11. Outside information put into the computer.
13. A set of instructions.

COMP LIT (7)

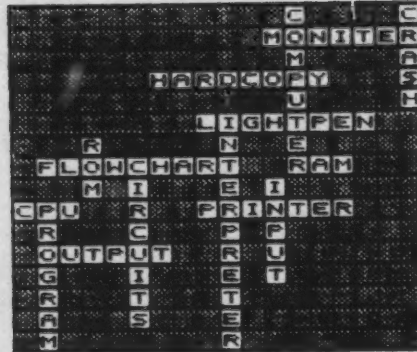
N V M E R V L V M C J W D C S M Y
 Z F P D B E M S U Y Z J I X O A Q
 S A Z Z O P R X G L W R O N D Q F
 B O O V I T Q B R O C J I O R M C
 X P J I V K R P P U Y T M E O O Z
 Y R R N B G P A I S E E T N J R N
 F O A X K D Q T H R Q U W O O P Y
 X G R L I T S T E C P O D X C K A
 S R C R U U H T U M W G C O R I T
 V A P T R R N J O P H O W F O G X
 J M U D X I A C N R T S L M C X N
 R E T E R P R E T N I U A F W K O
 A D C P U W B Y I Q G R O J F M I
 B F N R A K N H A R D C O P Y N H
 A C J L A N E P T H G I L J P F W
 V K Y Q Y S I W Y I C V B U X Z X
 Z M E T H J H Z G I R S T C F U V

THERE ARE 15 WORDS HERE - CAN YOU
 FIND THEM?

HERE ARE THE WORDS TO LOOK FOR:

CIRCUITS	COMPUTER
CPU	CRASH
FLOWCHART	HARDCOPY
INPUT	INTERPRETER
LIGHTPEN	MONITOR
OUTPUT	PRINTER
PROGRAM	RAM
ROM	

ANSWERS: COMP LIT (7)



COMP LIT (7)

. C . M .
 I . O .
 R . N .
 C . I . R M .
 . F . . . U . I . E . O .
 . R . . . A I . E . i . . R .
 . O . . . T H R . U
 . G . . . S T E C P
 . R O . . I U M W
 . H P . . N . O P . O
 . M O . . I . C . I . L N . .
 R E T E R P R E T N I U A F . . .
 . . C F R O . . . I
 . . . R . . . H A R D C O P Y N .
 . . . A N E P I H G I L . F . .
 S U . . .
 H I . . .

GRADE 7 - I PRETEST

COMPUTERS IN THE TWENTIETH CENTURY

Name _____

- ___ 1. A computer can be used to count calories and monitor exercise when a person is on a diet.
A. false B. true
- ___ 2. At the Illinois Medical Center, a medical student can practice on a 'computer patient'.
A. false B. true
- ___ 3. Computer robots are replacing men on the assembly line in Detroit's auto industry.
A. false B. true
- ___ 4. A computer can balance your checkbook.
A. false B. true
- ___ 5. New York's famous Metropolitan Museum of Art uses a computer to classify Egyptian pottery.
A. false B. true

GRADE 7 - 11 PRETEST

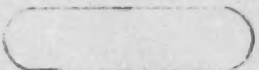
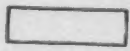
COMPUTER ORGANIZATION AND OPERATION

Name _____

- ___ 1. Input is the way in which the outside world communicates with the computer.
A. true B. false
- ___ 2. A program is a set of instructions that tells the computer what not to do.
A. true B. false
- ___ 3. Computer output can indicate errors have occurred in the program.
A. false B. true
- ___ 4. A computer monitor is a person who watches a computer to make sure no harm comes to it.
A. false B. true
- ___ 5. A light pen is an input device that senses light on the computer screen.
A. false B. true
- ___ 6. Information can be recorded on disks, punched cards, paper tape, or cellophane tape.
A. true B. false
- ___ 7. The CPU interprets directions to the computer.
A. true B. false
- ___ 8. An interpreter is a program that translates your instructions into a 'language' the computer can understand.
A. true B. false
- ___ 9. The CRT is the Computer Record Tester.
A. true B. false
- ___ 10. Output printed on paper is called Hard Copy.
A. true B. false

FLOWCHARTING

Name _____

- ___ 1. A flowchart is a graph that shows how electricity flows through the computer.
A. false B. true
- ___ 2. The symbol  represents the beginning or end of a flowchart.
A. false B. true
- ___ 3. You must follow every arrow in a flowchart.
A. true B. false
- ___ 4. A decision is indicated by a .
A. false B. true
- ___ 5. Flowchart symbols are standard so everyone can read the same flowchart.
A. false B. true
- ___ 6. A flowchart may be written that will add any three numbers.
A. false B. true
- ___ 7.  indicates instructions to be followed.
A. false B. true
- ___ 8. A flowchart shows every step in a program, but not necessarily in the correct order.
A. true B. false
- ___ 9. Flowcharting symbols are usually very complicated so you can tell the difference between different types.
A. false B. true
- ___ 10. Writing a flowchart should come after the actual writing of the program.
A. false B. true

COMPUTERS IN THE TWENTIETH CENTURY

Name _____

- ____ 1. When we say a computer 'understands' an instruction, we mean
- A. It can print out a definition of the instruction.
 - B. The computer's keyboard has a key corresponding to the instruction.
 - C. The computer can explain the meaning of that instruction.
 - D. The computer can execute (carry out) that instruction.
- ____ 2. Computer systems can be used to:
- A. Regulate gas consumption in an automobile.
 - B. Solve engineering and scientific problems.
 - C. All of the answers are correct.
 - D. Control electric appliances.
- ____ 3. Most things computers do:
- A. Can be done more cheaply if larger computers are used.
 - B. Can be done in other ways.
 - C. Can only be done by computer.
 - D. ~~Can be done more reliably by hand.~~
- ____ 4. A task quite suited to a computer is:
- A. To take off, pilot, and land a small plane flying from Chicago to LA.
 - B. To print out 'personalized' form letters for advertising purposes.
 - C. To read an X-ray and recommend treatment for any disease it detects.
 - D. To take over most functions currently performed by teachers.
- ____ 5. A walking, talking robot is most likely to be found:
- A. Working as a computer operator.
 - B. Working in a modern factory.
 - C. Teaching in a school or university.
 - D. In a science fiction movie.

COMPUTER ORGANIZATION AND OPERATION

Name _____

1. Which of the following is a type of input device?
A. Disk. C. Printer.
B. Light Pen. D. Pencil.
2. Output communicates information from:
A. The programmer to the printer.
B. The computer to the programmer.
C. The user to the programmer.
D. The programmer to the computer.
3. A program can tell the computer to:
A. All answers are correct.
B. Compare information.
C. Get information from the user.
D. Do calculations.
4. Information to be processed by a computer is called:
A. Files. C. Intelligence.
B. Records. D. Data.
5. The electronic logic networks which interpret directions to the computer are part of the:
A. CPU. C. Monitor.
B. Graphics Tablet. D. Keyboard.
6. RAM is:
A. Memory that never changes.
B. Memory that is lost when the computer is turned off.
C. Memory kept only on a disk.
D. All answers are correct.
7. An example of a storage device is:
A. Diskettes. C. Cassettes.
B. All answers are correct. D. Floppy Disks.
8. A computer program:
A. Is a television program about computers.
B. Lists instructions to the computer operator.
C. Is about the same thing as output.
D. Contains step-by-step instructions to solve a certain type of problem.
9. The paper that output is printed on is sometimes known as:
A. CPU. C. CRT.
B. Hard Copy. D. The Monitor.
10. The order in which data flows through the computer is as follows:
A. CPU-->Input Unit-->Output Unit.
B. Input Unit-->CPU-->Output Unit.
C. Output Unit-->CPU-->Input Unit.
D. Input Unit-->Output Unit-->CPU.

FLOWCHARTING

1. A flowchart is:
- A. A representation of instructions for performing a task.
 - B. Hardly ever used.
 - C. A roadmap.
 - D. A graph of the flow of electricity through a computer.
2. The symbol  is used to signify:
- A. A decision.
 - B. A beginning or ending.
 - C. A statement.
 - D. All the answers are correct.
3. A flowchart is:
- A. Drawn after writing the program.
 - B. Drawn after testing the program.
 - C. Drawn after documenting the program.
 - D. Drawn to illustrate the steps required in a program.
4. A parallelogram is used to represent:
- A. Beginning or ending.
 - B. Instructions.
 - C. A decision.
 - D. Input or output.
5. A flowchart:
- A. Is used in the design of a program.
 - B. All of the answers are correct.
 - C. Is drawn before the program is executed.
 - D. Illustrates major tasks needed to solve a computer problem.
6. Flowcharting symbols are usually:
- A. Different, depending on the person who's using them.
 - B. Complicated geometric shapes.
 - C. Very small, to save space.
 - D. Simple figures.
7. Instructions to be followed are represented by:
- A. An oval.
 - B. A diamond.
 - C. A rectangle.
 - D. A square.
8. When you see an arrow:
- A. You always follow it.
 - B. You sometimes follow it.
 - C. You follow it unless it leads to the end.
 - D. You never follow it.
9. The beginning or ending of a program is signified by:
- A. A diamond.
 - B. An asterisk.
 - C. An oval.
 - D. A rectangle.
10. When writing a flowchart, you:
- A. Write the steps in the correct order.
 - B. Write down every little detail.
 - C. Write the steps in computer language.
 - D. Write steps as you think of them, not necessarily in the correct order.

GRADE 7 - I PRETEST

Numbered Answer Key

1	B	2	B	3	B	4	B
5	B						

GRADE 7 - II PRETEST

Numbered Answer Key

1	A	2	B	3	D	4	A
5	B	6	B	7	A	8	A
9	B	10	A				

GRADE 7 - III PRETEST

Numbered Answer Key

1	A	2	B	3	B	4	B
5	D	6	B	7	B	8	B
9	A	10	A				

GRADE 7 - I POSTTEST

Page 47

Numbered Answer Key

1	D	2	C	3	B	4	E
5	B						

GRADE 7 - II POSTTEST

Numbered Answer Key

1	E	2	D	3	A	4	D
5	A	6	B	7	B	8	D
9	B	10	B				

GRADE 7 - III. POSTTEST

Numbered Answer Key

1	A	2	A	3	D	4	D
5	B	6	D	7	C	8	B
9	C	10	A				

SYLLABUS

GRADE 8

I. COMPUTER ORGANIZATION AND OPERATION

A. The Problem Solving Process

1. Understand the problem

When you try to understand a problem, it is necessary to follow these steps:

- a. Read the problem slowly and carefully.
- b. Determine all the given and how it interrelates.
- c. Find out what the problem is asking for.

2. Formulate a solution plan

When you formulate a plan for solving a problem, it is helpful to ask yourself the following questions:

- a. Is there more than one way to solve this problem?
- b. Is there a best way?
- c. Have I ever seen a problem like this before?
- d. Are there equations, operations, or additional information that will help me solve this problem?

Once you answer these questions, you should have a rough idea of how you would like to proceed. The ALGORITHM (set of steps needed to solve a specific problem) you choose to follow is best perfected with a FLOWCHART. To write a flowchart, you must have each step exactly the way it should be to solve the problem. It is at this point that you must organize your given and any necessary equations/operations into an exact set of instructions in the proper order.

(Flowcharting is explained in more detail later in this unit)

3. Carry out plan and look back

Once you have written your flowchart, you must convert the steps into a computer language and run the program. If the program does not run successfully, look back to your plan for any procedural mistakes. You could also look for any mistakes you may

have made in converting the steps in your flowchart to computer language.

EXAMPLE PROBLEM

If one candy bar costs \$.33, how much will 5 candy bars cost?

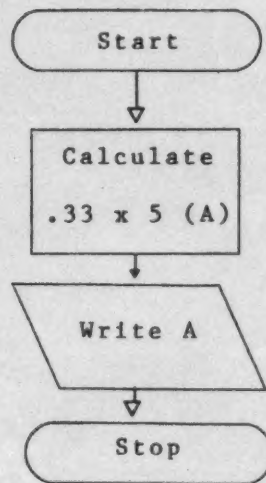
1. Read the problem.
2. Determine the given.
\$.33 per candy bar
5 candy bars
3. What is the problem asking for?
the cost of 5 candy bars

Formulate the plan

(Notice the dollar sign is not used in the actual solving of the problem.)

1. Is there more than one way to solve the problem?
The problem can be solved by repeated addition, $.33+.33+.33+.33+.33$, or by multiplication, $.33 \times 5$.
2. Is there a best way?
Multiplication, $.33 \times 5$, is the quicker method.
3. Have I ever solved a problem like this before?
In most cases, your answer would be yes.
4. Any equations or operations?
Multiplication is the operation we will be using.

Flowchart



Write the program

```

10 A=.33 x 5
20 PRINT "THE ANSWER IS $";A
30 END
  
```

At this point, you would run the program. On the screen you should see:

THE ANSWER IS \$1.65

If not, go back and check for procedural mistakes or errors in converting the flowchart to a program.

B. Software

1. Definition of a program

A program is a detailed, step by step, set of instructions telling a computer exactly how to solve a certain type of problem. It must be written in a language 'understood' by the computer. A typical computer understands about 100 to 200 different instructions. Different brands of computers have different sets of

instructions. These often include instructions for addition, subtraction, multiplication, division, and for comparing numbers. They also include instructions for moving data to and from primary, or Random-access memory, and secondary storage. These instructions are called COMMANDS.

An example of a program written in the BASIC language.

```
10 PRINT "WHAT ARE YOUR THREE NUMBERS?"
20 INPUT X,Y,Z
30 LET A=(X+Y+Z)/3
40 PRINT "THE AVERAGE OF YOUR THREE NUMBERS IS ";A
50 END
```

In this program the computer will ask you to type in three numbers and will then find the average of those three numbers and output the average.

2. Programming languages

A program is a set of instructions that tells the computer how to solve a certain problem. For the computer to execute the program, it must be in a specific language the computer can understand. Certain computers understand specific languages just as people do. If you 'talk' to a computer in a language other than one it 'speaks', you won't get an answer.

Some different kinds of languages include FORTRAN (FORMula TRANslator), PASCAL (named after Blaise PASCAL), COBOL (COMMON Business Oriented Language), and the most commonly used in

microcomputers, BASIC (Basic All-purpose Symbolic Instruction Code). As you can see, some languages are better suited to certain tasks. COBOL, for example, is better suited to the business world while FORTRAN is a mathematical/scientific language. Schools use mostly BASIC because it is, as it says, an all purpose language and can be used for a variety of tasks. Another reason BASIC is commonly used in schools is the fact that it is easier to learn other languages once you know BASIC.

3. Binary code

Computers do not understand language commands directly. A computer's circuitry works with electricity. It has switches which are either 'open' or 'closed', a spot on a magnetized disk is 'magnetized' or 'not magnetized', the current is either 'flowing' or 'not flowing'. The symbols 0 and 1 are used to represent the open/closed, magnetized/not magnetized, and flowing/not flowing ideas in the computer.

Thus, the binary system, which uses just 0's and 1's, is the 'alphabet' of the computer. The machine language of a computer is designed to work with instructions and data in the binary code, as a series of 0's and 1's.

If a program is written in BASIC, in order for the computer to execute it, the BASIC instructions must first be translated into binary code. This is done by a program called a 'interpreter'. The interpreter is usually supplied by the manufacturer and may be thousands of instructions long.

C. Components of a Computer System

1. Types of input units

The input unit of a computer system feeds information from the outside world into the computer. This information includes both data and instructions (programs). Computers are capable of reading information recorded in several different ways.

A keyboard can be used to send information directly to the computer's memory. This is the most common input device currently in use. The information being recorded is usually displayed on a monitor or TV.

Information can also first be recorded on disks, punched cards, paper tape, or magnetic tape (cassettes) and then read into the computer's memory.

A light pen is another type of input device. It looks like a pen and is connected to the computer by a cable. It senses light on the computer screen or graphics tablet and feeds the information back to the computer.

Many programs, especially game programs, require information to be sent to the computer by means of a joystick or paddles. These input devices can be attached to the computer by a cable when needed.

2. Central processing unit

The CPU, as previously stated, is the part of the computer that interprets instructions. It has two parts - the ARITHMETIC UNIT and the CONTROL UNIT.

a. Arithmetic unit

This is the part of the computer where calculations take place. Even though the arithmetic unit can be programmed to perform complicated problems, it can only add and compare numbers. It uses these two operations for everything.

Addition is a very powerful operation in calculations. For example, to solve the problem 3×10 , the computer adds 10 three times: $10+10+10$. If the problem was 89×256 , you would think this would take a very long time but, in fact, the computer can calculate this problem in less than a millionth of a second.

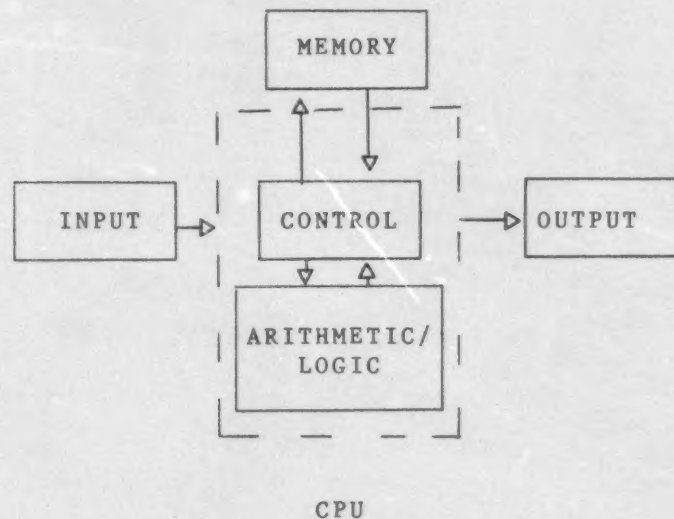
Computers are so fast that scientists measure their speed in NANOSECONDS. A NANOSECOND is a billionth of a second. It takes about 4 nanoseconds for a computer to calculate $26,529 \times 629,104,888$.

A computer can also compare numbers. For example, if a policeman wanted to run a check for a stolen car, he can compare the license plate number he has with the computer's list of license plate numbers from stolen cars and see if any match.

b. Control unit

The control unit is the unit that controls the flow of information through the computer. It can send information to memory to be stored and take information from memory to be processed. It can send information to and from the Arithmetic Unit to be calculated and compared. It can also send information to an output device to be displayed. The control unit sends all the information to the right places in the necessary order, much the

same way a traffic cop moves cars through an intersection. You would think a very long program would get bogged down in the control unit but, once again, the computer is very fast. The speed that information moves through the control unit is measured in nanoseconds.



D. Classifying Computers

Computers are divided into two types: analog and digital. The analog computer solves problems by measuring continuously occurring variable physical conditions such as pressure, voltage, temperature, speed, or position. These measurements are then translated into some continuous, meaningful output. Examples of an analog computer include the slide rule, speedometer, and thermometer.

The digital computer is the most versatile machine of the electronic computer family. It performs calculations by counting and represents the information only as numbers (binary code). Digital computers work on data mathematically rather than physically as done by the analog computers. The term 'computer' as

used in this unit refers to a digital computer.

1. Purpose

When we think of a computer, we usually picture a highly sophisticated machine that can perform a variety of different tasks. This is a general purpose computer. The general purpose computer can do anything from word processing to budgeting to game-playing. There is a wide range within this 'general purpose' category. The low-end microcomputers are small portable units with limited expansion capacity. They are the most popular and least expensive type of general purpose microcomputer. The high-end microcomputer accepts more peripherals, has a larger memory, and is usually more expensive.

A specific purpose computer is a computer that has only one application. A computer that is designed to control a task on an assembly line, or play a video game, or generate a graphics design, or simply turn on your microwave oven is a specific purpose computer.

2. Size and capabilities

The microcomputer is currently the most common and widely publicized computer. Microcomputers, or micros, can be found in many homes, businesses, and schools. They are used to stimulate learning, perform calculations, and keep track of information. Because microcomputers are relatively inexpensive, they are in use in many varied environments.

The minicomputer is a medium-sized computer that has more main and auxiliary storage than the microcomputer, but it also costs more. The increased memory capacity makes the minicomputer very popular in business, science, and engineering fields.

The large computer, or 'mainframe', is used in applications which require the execution of millions of instructions each second. A mainframe usually has a complex system of storage devices which allows great quantities of data to be available for accessing. With the development of the small, powerful, inexpensive computers, mainframes are used only when absolutely necessary.

II. LIMITATIONS

Computer cost is a limitation of computer accessibility. They can be rather prohibitively expensive; but, as with calculators a few years ago, this is rapidly changing. The availability of good, usable software is another drawback. Storage capacity can, but does not need to be, a limitation. Different computers have a capability of storing from a few thousand to a few million characters. A wise shopper can avoid this pitfall by finding out what he/she needs before buying.

As far as the computer itself, although it is extremely fast, it is incapable of anything more than carrying out the instructions given to it by the programmer. Computers cannot generate their own problems. They can only be of use in solving a problem when they meet the following criteria:

1. A program can be written that gives the computer exact instructions as to what needs to be done.
2. The necessary data can be obtained and fed into the computer.
3. The computer's storage capacity is large enough to hold the program and data.
4. The computer is fast enough to make its use worthwhile.
5. The use of the computer is justified by saving either time, money, or energy.

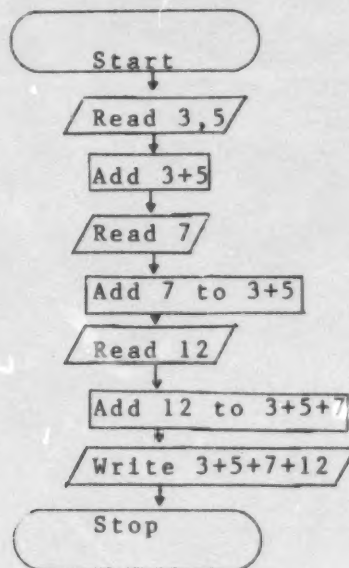
A recent problem with the use of computers is in relation to privacy. Financial institutions, governmental and law enforcement agencies have access to large amounts of information that individuals may consider personal. This creates problems in ethics for computer workers and users as to the use of medical, financial, and legal records.

III. FLOWCHARTING AND PROBLEM SOLVING

A. Linear Flowcharts

Most of the flowcharts addressed earlier were linear. These flowcharts go from one step to the next without backtracking. An example would be a flowchart for how to add four numbers: 3, 5, 7, and 12.

Example 1



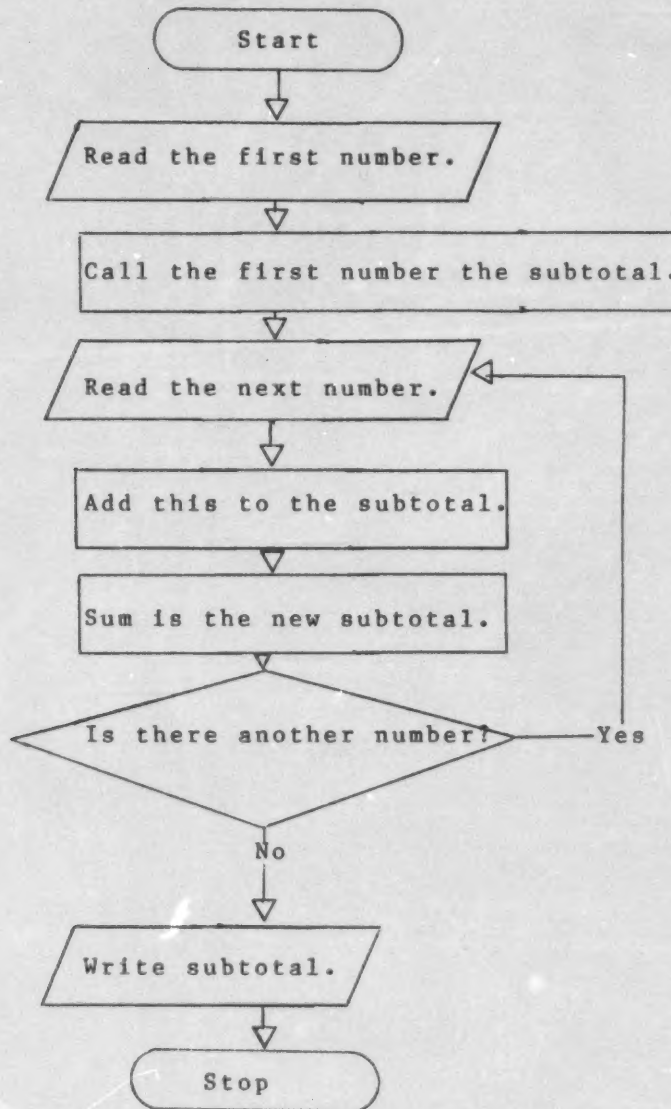
Linear flowcharts are easy to follow and are used with short problems. However, they become too long to use with harder problems. If we were to add ten or twenty numbers, Example 1 would have been very long.

B. Looping

There is an easier method for harder problems. This method enables the writer to do the same steps more than once without elongating the flowchart. Such a method is called a LOOP. A loop will cause certain steps in the problem to be followed as many times as you wish. A loop will be used to write a flowchart for

adding several numbers as follows:

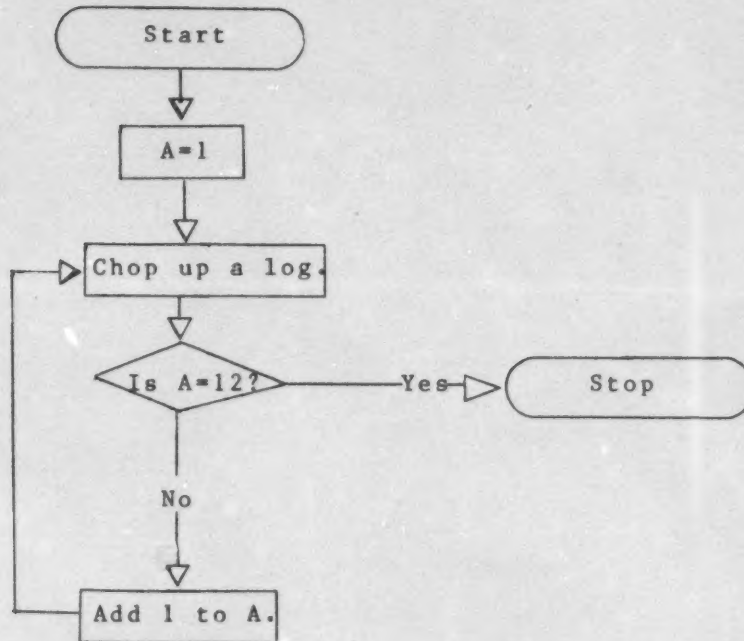
Example 2



Notice in Example 2 that the middle steps will be done over and over again until there are no more numbers to add.

A flowchart for the next problem is made shorter by a loop.
Problem: Chop up 12 logs into firewood.

Example 3



In this example, the letter A is used as a counter. It will keep track of the number of logs that are chopped up. Thus, the instructions in the loop are carried out 12 times before the problem ends.

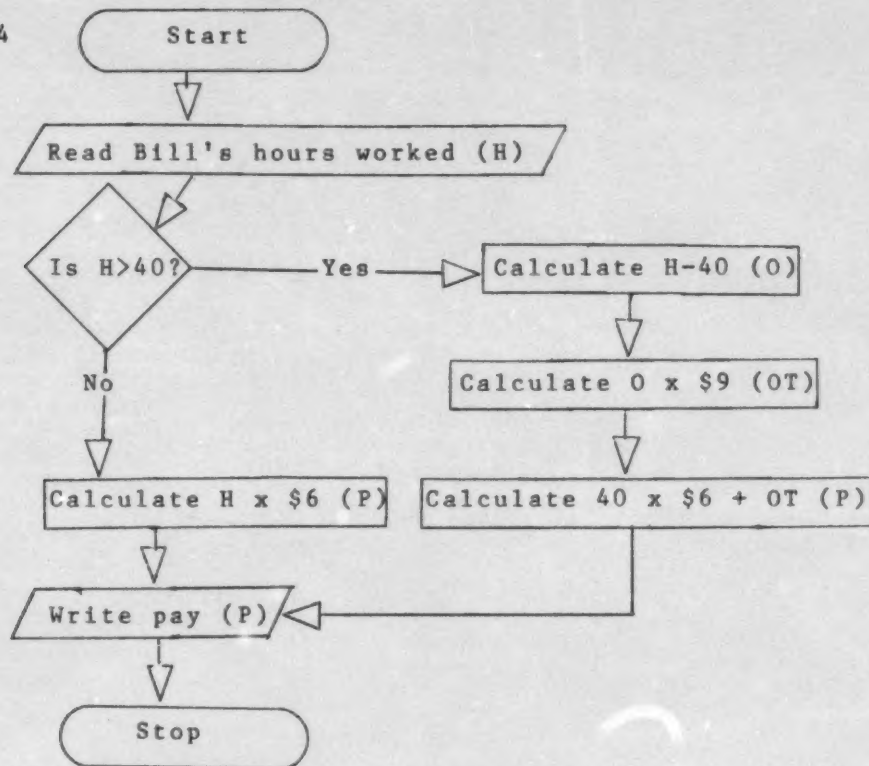
C. Subroutines

When a problem becomes more complex, it will be more difficult to write and follow a flowchart. One way in which flowcharts are kept less complex is to divide it into two or more smaller parts called SUBROUTINES. Each subroutine performs a particular task in the flowchart. The overall flowchart is then easy to understand as it consists of a number of simple parts.

Subroutines make this next problem easier. Problem: Bill gets paid \$6 an hour for his normal 40 hours of work and \$9 (time and a half) for any hours worked over 40 (overtime). Write a flowchart

that will calculate Bill's pay for any amount of hours worked.

Example 4



In Example 4, H means the hours worked, O means the hours worked over 40, P means the pay, and OT means the overtime pay. Notice that the flowchart divides into two parts after 'Read Bill's hours worked (H)'. One part will calculate the normal pay if the hours are 40 or fewer and the other part calculates the overtime pay if the hours are over 40. These two parts come back together in 'Write pay (P)'.

This unit has been a very brief look at flowcharting. Flowcharts are often very useful in solving problems and as an aid in writing computer programs. For further information and examples, refer to 'Flowcharting' by McQuigg and Harness from Houghton Mifflin Company.

LESSON PLANS
AND
SUGGESTED
EXERCISES

GRADE 8

LESSON PLAN (3 To 5 Days)

GRADE 8 - I. COMPUTER ORGANIZATION AND OPERATION

A. The Problem Solving Process

1. Understand the problem
2. Formulate a plan
3. Carry out plan and look back

OBJECTIVES:

1. Student will be able to read and understand a problem, paying special attention to 'key' words and phrases.
2. Student will be able to formulate a solution to the given problem, using a flowchart.
3. Student will be able to carry out his/her plan by writing a computer program.
4. Student will check his/her work.

MATERIALS NEEDED:

Problem solving outline (enclosed)

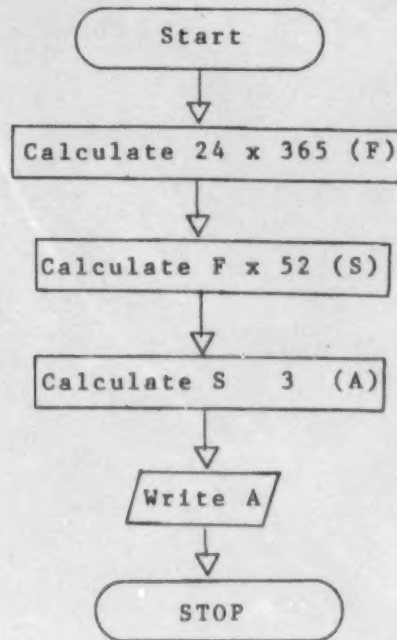
Computer (for demonstration on the first day - needed only for running student programs after that)

LESSON FORMAT:

1. Hand out copies of the problem solving outline to students and read through.
2. Put the following problem on the board:

Assuming everyone sleeps $\frac{1}{3}$ of the time, how many hours did Al sleep if he lived to be 52 years old? A year has 365 days (disregard leap years).

3. Guide students carefully through the outline, using the above problem as an example. The flowchart should look like the following. Also shown is an example of what the solution of this problem looks like in BASIC and its output.



```

10 LET F = 24 * 365
20 LET S = F * 52
30 LET A = S/3
40 PRINT "THE NUMBER OF HOURS AL SLEPT WAS ";A
50 END
  
```

Output:

THE NUMBER OF HOURS AL SLEPT WAS 151840

4. Break students into groups of 2 or 3 and have them go through parts I and IIA of the outline on a problem of your choice. (There is a list of problems at the end of this lesson plan you could choose from.)
5. Go over students' work as a class.
6. Explain the term ALGORITHM.
7. Have the same groups continue and work on parts IIB and IIC of the outline.
8. Go over students' work as a class.
9. Have students convert their algorithms to computer language and run the programs when possible.
10. Take a few programs and go through the checking steps with the whole class.
11. Select one or more of the SUGGESTED EXERCISES for the students to complete.

SUGGESTED EXERCISES:

1. For the first year, the insurance on an automobile that cost \$5276 was \$362.17. The insurance for the second year was \$380.54. What was the increase in cost of the insurance?
2. In the 1976 Olympics, Bruce Jenner scored 8618 points to win the decathlon event. This was 164 points more than the 1972 record. How many points were scored to win the 1972 decathlon?
3. A small business had expenses as follows:
January: \$7628.59
February: \$7847.64
March: \$9495.54

- Income for the three months was \$32,076.95. How much was the profit?
4. In the summer, for every mule deer at Yellowstone there are about 30 elk. There are 21,000 elk. How many mule deer are there?
 5. The Spanish treasure ship Atocha was discovered in 1971, 349 years after it had sunk in a storm. In what year did the Atocha sink?
 6. Nancy took four tests. Her marks were 95, 68, 92, 88. What was her average score?
 7. In Miami, Florida, Lulu Rocket appeared at several social events in the role of 'Miss Metric'. Her 'vital statistics' are 89-58-89 centimeters. She is 170 centimeters tall and weighs 53 kilograms. What are her statistics in inches, her height in feet and inches, and her weight in pounds?
 8. Mariner 9 took 167 days to travel from Earth to Mars, a distance of about 34,900,000 miles. What is the average speed in kilometers per hour?
 9. If there are 25 players on a team and 5 of them are over 6'5", what percent of the players are over 6'5"?
 10. On Mrs. Tharpe's farm, the hens laid 4,000 eggs in one day. If Mrs. Tharpe sold the eggs for 42 cents per dozen, how much can she make in one day?

PROBLEM SOLVING OUTLINE

I. Understand the Problem

- A. Read the problem.
- B. Determine all given and how it interrelates.
- C. Find out what the problem is asking for.

II. Formulate Plan

A. Ask the following questions:

- 1. Is there more than one way to solve this problem?
- 2. Is there a best way?
- 3. Have I ever seen a problem like this before?
- 4. Are there equations, operations, or additional information that will help me solve this problem?

B. Design an algorithm.

C. Write a flowchart.

III. Carry Out Plan - Convert to computer language and run program.

IV. Look Back - See if answer is what the problem is looking for.

If not:

- A. Check for mistakes in your algorithm.
- B. Check for errors in conversion to computer language.

LESSON PLAN (1 TO 2 DAYS)

GRADE 8 - I. COMPUTER ORGANIZATION AND OPERATION

B. Software

1. Definition of a program
2. Programming languages
3. Binary code

OBJECTIVES:

1. Student will recognize a program as a set of instructions or COMMANDS.
2. Student will recognize that programs must be written in a computer language.
3. Student will be able to identify different languages and their specific uses.
4. Student will be able to define a binary code.
5. Student will understand how and why binary code is used in computers.

MATERIALS:

Microcomputer (if possible)

ACTIVITIES:

1. Define program. You may want to give the following example relating a program to a recipe as a way to reinforce the need for specificity and exactness in programming:

Thumbprint Cookies

1/2 c. shortening, 1/4 c. brown sugar, 1/2 tsp. vanilla, 1 c. flour, 1/4 tsp. salt, 3/4 c. finely chopped nuts, 1 egg (yolk separated)

Directions:

1. Preheat oven to 350 degrees.
2. Mix shortening, sugar, egg yolk, and vanilla thoroughly.
3. Blend flour and salt together.
4. Stir into mixture.
5. Roll dough into balls.
6. Beat egg white slightly with a fork.
7. Dip balls in egg white and roll in nuts.
8. Place about one inch apart on an ungreased cookie sheet.
9. Press thumb gently in the center of each.
10. Bake for 10-12 minutes at 350 degrees Fahrenheit.

Questions:

- a. Does it matter if steps 7 and 2 are interchanged? 4 and 3? 10 and 8? etc.
- b. Are there any steps left out that you are 'understood' to know about?
- c. Is there any question at all about what the recipe wants you to do?

NOTE: Emphasize the fact that recipes are written precisely, so someone who knows absolutely nothing about cooking can follow them. This leads to the idea that computer programs are written precisely, so a 'dumb' computer can understand it.

2. Discuss programs and give examples. Some possible example programs are in the SUGGESTED EXERCISES section.
3. Discuss the idea of a programming language and give examples.
4. Explain the different uses for specific languages. You may want to relate programming languages to foreign languages by putting a message in a foreign language on the board. Explain that a computer doesn't understand certain languages any better than

the student understands the message.

5. Discuss binary code and why it is used in computers.
6. Explain INTERPRETER. Again, you may want to relate this to a foreign language interpreter.

SUGGESTED EXERCISES:

1. Crossword puzzle . (enclosed)
2. Give the students example problems and ask them if the order of COMMANDS matters.

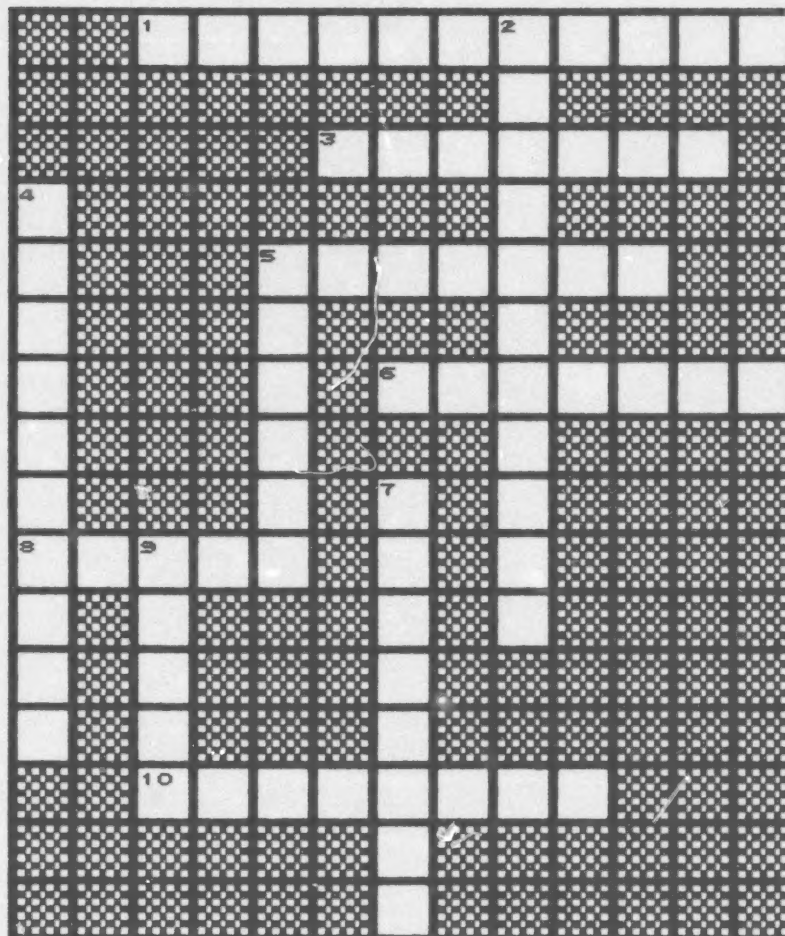
(a)

```
10 LET X = 9
15 LET Y = 12
20 PRINT"PROBLEM 1 (SUM)"
25 PRINT X + Y
30 PRINT"PROBLEM 2 (PRODUCT)"
35 PRINT X * Y
40 END
```

(b)

```
10 LET Y = 1970
20 LET P = 200
30 PRINT "YEAR","MILLIONS OF PEOPLE"
40 PRINT Y,P
50 END
```

3. Make a list of problems and/or activities you can use the computer for and what language you would use.



ACROSS CLUES

1. What a computer's circuitry works with.
3. FORMula TRANslator.
5. A detailed set of instructions telling a computer exactly how to solve a certain problem.
6. Something that is either 'flowing' or 'not flowing' through a computer.
8. A computing language best suited to the business world.
10. Instructions.

DOWN CLUES

2. A program that translates commands into binary code.
4. The 'alphabet' of the computer.
5. A computing language named after Blaise Pascal.
7. Something a computer must 'speak' before it can understand you.
9. An all-purpose computing language used in most schools.

LESSON PLAN (1 TO 2 DAYS)

GRADE-8 I. COMPUTER ORGANIZATION AND OPERATION

C. Components of a computer system

1. Types of input units
2. Central processing unit
 - a. arithmetic unit
 - b. control unit

OBJECTIVES:

1. Student will be able to name three types of input units.
2. Student will be able give the function of the CPU.
3. Student will be able to name the two parts of the CPU and describe their functions.
4. Student will be able to define a nanosecond.
5. Student will be able to describe the relationship between input, memory, CPU, arithmetic and control units, and output.

MATERIALS NEEDED:

Copies of part IC of the eighth grade syllabus.

Microcomputer (where possible)

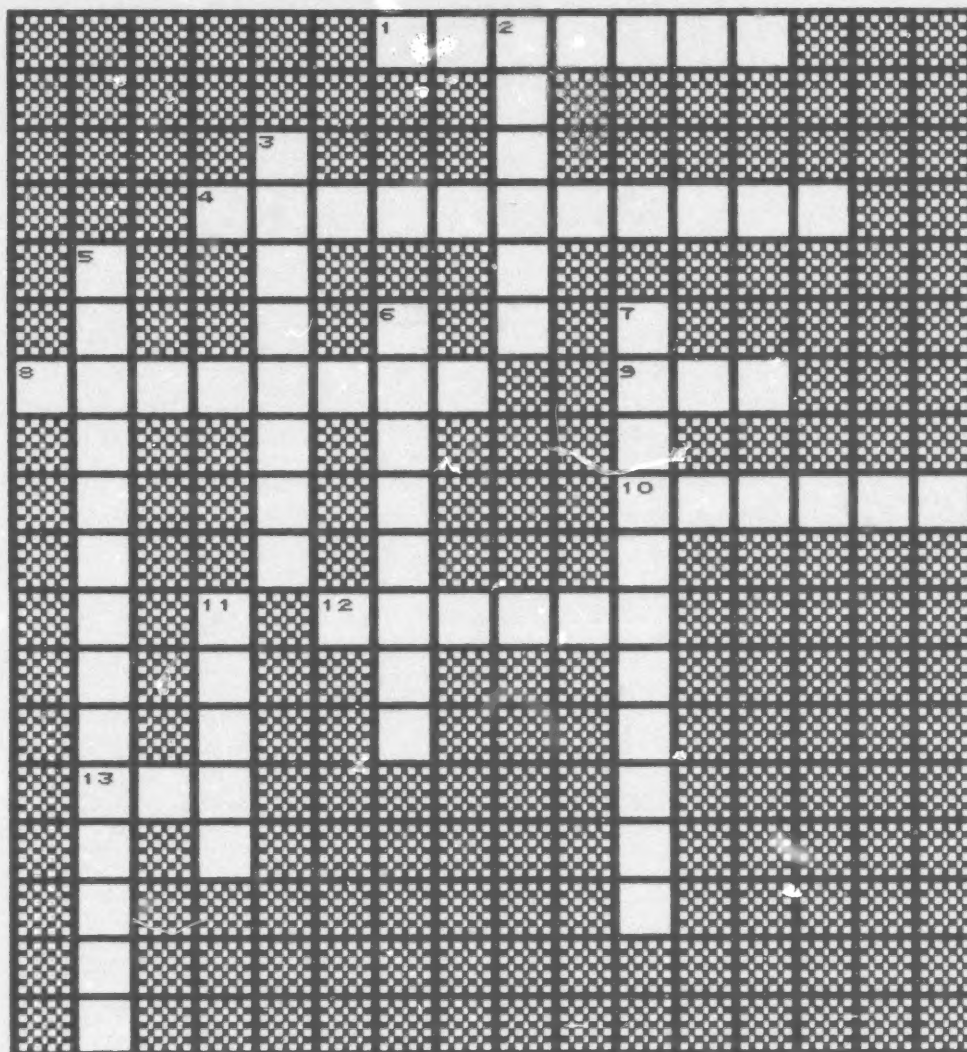
LESSON FORMAT:

1. Display the microcomputer in the room, so that all students may have the opportunity to observe it; or, make a bulletin board display of different types of computers and computer units.

2. Have students review the functions of input and output along with types of input and output units.
3. Have students read the pages from the syllabus.
4. Discuss the CPU and its two parts. Have students generate ideas for a list of the functions of the two parts.
5. Demonstrate how different problems would be solved by the arithmetic unit.
6. Select one or more of the suggested exercises.

SUGGESTED EXERCISES:

1. Have students solve the following problems using the same method as the arithmetic unit.
 - a. 45×5
 - b. 30×7
 - c. $25 - 5$
 - d. $36 - 42$
 - e. $36/6$
 - f. $80/20$
2. Draw a diagram showing the relationship between input, memory, CPU, arithmetic and control units, and output.
3. Crossword puzzle (included).



ACROSS CLUES

1. Way to use numbers to check on stolen vehicles.
4. Controls the flow of information through the computer.
8. Senses light on a monitor screen or graphics tablet.
9. One of the arithmetic unit's operations.
10. Information or results generated by the computer during the running of a program.
12. Two-directional input device used for playing games.
13. Microprocessor chip that interprets instructions to the computer.

DOWN CLUES

2. A computer's storage device.
3. Four-directional input device used for playing games.
5. Part of the computer where calculations take place.
6. Most commonly used input device.
7. A billionth of a second.
11. Way in which the outside world communicates with the computer.

LESSON PLAN (1 TO 2 DAYS)

GRADE-8 I. COMPUTER ORGANIZATION AND OPERATION

D. Classifying computers

1. Purpose
2. Size and capability

OBJECTIVES:

1. Student will be able to differentiate between the uses of analog and digital computers and give an example of each.
2. Student will be able to define general purpose and specific purpose computers and give an example of each.
3. Student will be able to describe the difference between a micro, mini, and mainframe computer and give an example of each of their uses.

MATERIALS NEEDED:

Magazines

Construction Paper

Magic Markers

Scissors

LESSON FORMAT:

1. Discuss the analog and digital computers. Have students generate examples of each type.
2. Describe general and specific purpose computers. Have students name examples of both general and specific purpose computers.

3. Discuss the difference between micro, mini, and mainframe computers.
4. Select one or more of the suggested exercises.

SUGGESTED EXERCISES:

1. Create a bulletin board displaying pictures of micro, mini, and mainframe computers with examples of each of their uses.
2. Take a field trip to a computer manufacturer or a business using computers. Find out what types of computers they manufacturer or use; and, for what purpose. (Possible suggestion, write: Jim McCracken, IBM Corp.-Communications, Dept. 775 Bldg. 002-3, 1701 North St., Endicott, NY, 13760.)
3. Have students look for best computer buy for an imaginary business. Assign groups different types of businesses which will need various types of computers.

LESSON PLAN

GRADE 8 - II. LIMITATIONS

OBJECTIVES:

1. Student will identify an important limitation of the computer to be the fact that it is incapable of anything more than carrying out the instructions given to it by the programmer.
2. Student will describe the four criteria that must be met before a computer can be of use in solving a problem.
3. Student will identify another important limitation of the computer to be the potential lack of privacy in computer-kept records.
4. Student will identify cost as a limitation.
5. Student will identify the lack of good, useable software as a limitation.

MATERIALS NEEDED:

Eighth Grade Syllabus - part II

LESSON FORMAT:

1. Discuss the fact that computers can only do what programmers tell them to. Emphasize the fact that they are, in a sense, 'dumb', so a programmer must be very exact or the computer may not do what he thinks it will.
2. Define and discuss the four criteria that must be met for a computer to be useful, as defined in section 8II of the Eighth Grade Syllabus.

3. Discuss the problem of privacy in computer-kept records.
4. Discuss the cost of computers and its downward trend.
5. Discuss the lack of good, useable software. Emphasize the fact that programs that are purchased, often have 'bugs' or mistakes in them and cannot be used to their full capacity.

SUGGESTED EXERCISES:

1. Have students come up with problems and/or activities they think a computer could help with and see if they meet the four criteria discussed earlier.
2. Have students debate whether or not privacy is violated more with computer-kept records than it is with records kept in a filing cabinet.
3. Have individuals gather copies of federal and state laws covering privacy or billing errors.
4. As individuals or groups, ask a local bank what privacy safeguards they enforce.

LESSON PLAN (1 TO 2 DAYS)

GRADE 8 - III. FLOWCHARTING AND PROBLEM

A. Linear Flowcharts

B. Loops

C. Subroutines

OBJECTIVES:

1. Student will be able to define 'linear flowchart'.
2. Student will be able to define 'loop' and 'subroutine'.
3. Student will be able to read and write a flowchart using a loop to solve a problem.
4. Student will be able to read and write a flowchart using a subroutine to solve a problem.

MATERIALS NEEDED:

Microcomputer (if possible)

Computer Literacy Supplemental Disk

Eighth grade syllabus - Part III A, B, C

Seventh grade syllabus - Part III C, D

LESSON FORMAT:

1. Review concept of a linear flowchart. You may wish to take examples from the seventh grade syllabus - part III C, D.
2. Define 'loop' and 'subroutine'. Use the disk and run the programs LOOPS and SUBROUTINE to display the definitions on a monitor.
3. Show students an example of a flowchart with a loop found in the eighth grade syllabus - part III A, B. You may put this on

an overhead transparency, blackboard, or duplicate the text to be distributed to the students. Allow the students to attempt to figure out what is happening in the flowchart. If the students are not able to determine what is happening in the flowchart, be sure to work through the example with them.

4. Show students an example of a flowchart with a subroutine found in the eighth grade syllabus - part III C. Trace the steps of the flowchart with the students.
5. Assign students one or more of the suggested exercises to be completed. Due to the increased difficulty of the exercises, it may be necessary to help the students analyze the problem before they attempt to write the flowchart.

SUGGESTED EXERCISES:

1. Write a flowchart to calculate the sum of the whole numbers from 1 to 100, inclusive.
2. Write a flowchart to calculate the sum of the squares of the whole numbers from 1 to 20, inclusive.
3. Write a flowchart to calculate the average of any amount of numbers.
4. At the mint, machine A can stamp 60 coins an hour and machine B can stamp 50 coins an hour. Machine A runs every day and machine B runs only on Tuesdays and Thursdays. Write a flowchart, using subroutines, to calculate the number of coins stamped in any day. You should read the day of the week, the hours that machine A worked, and the hours that machine B worked (if any).

5. Ding Dong Telephone Company uses the following rates:

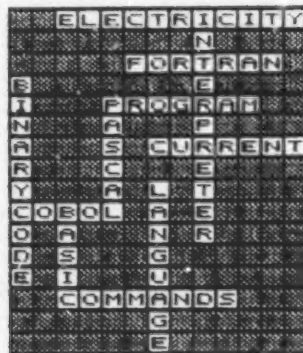
\$.20 for each use up to 30 calls.

\$.15 for each use between 31-50 calls.

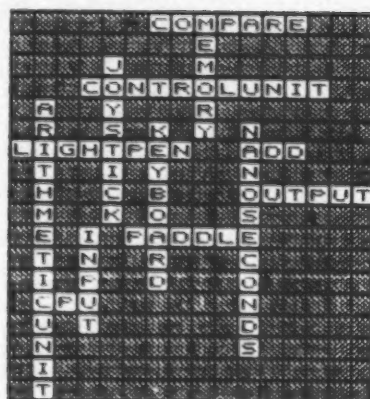
\$.10 for each use over 50 calls.

Write a flowchart, using subroutines, to calculate a phone bill by reading the number of calls.

ANSWERS: SOFTWARE



ANSWERS: COMPONENTS



SUPPLEMENT

GRADE 8

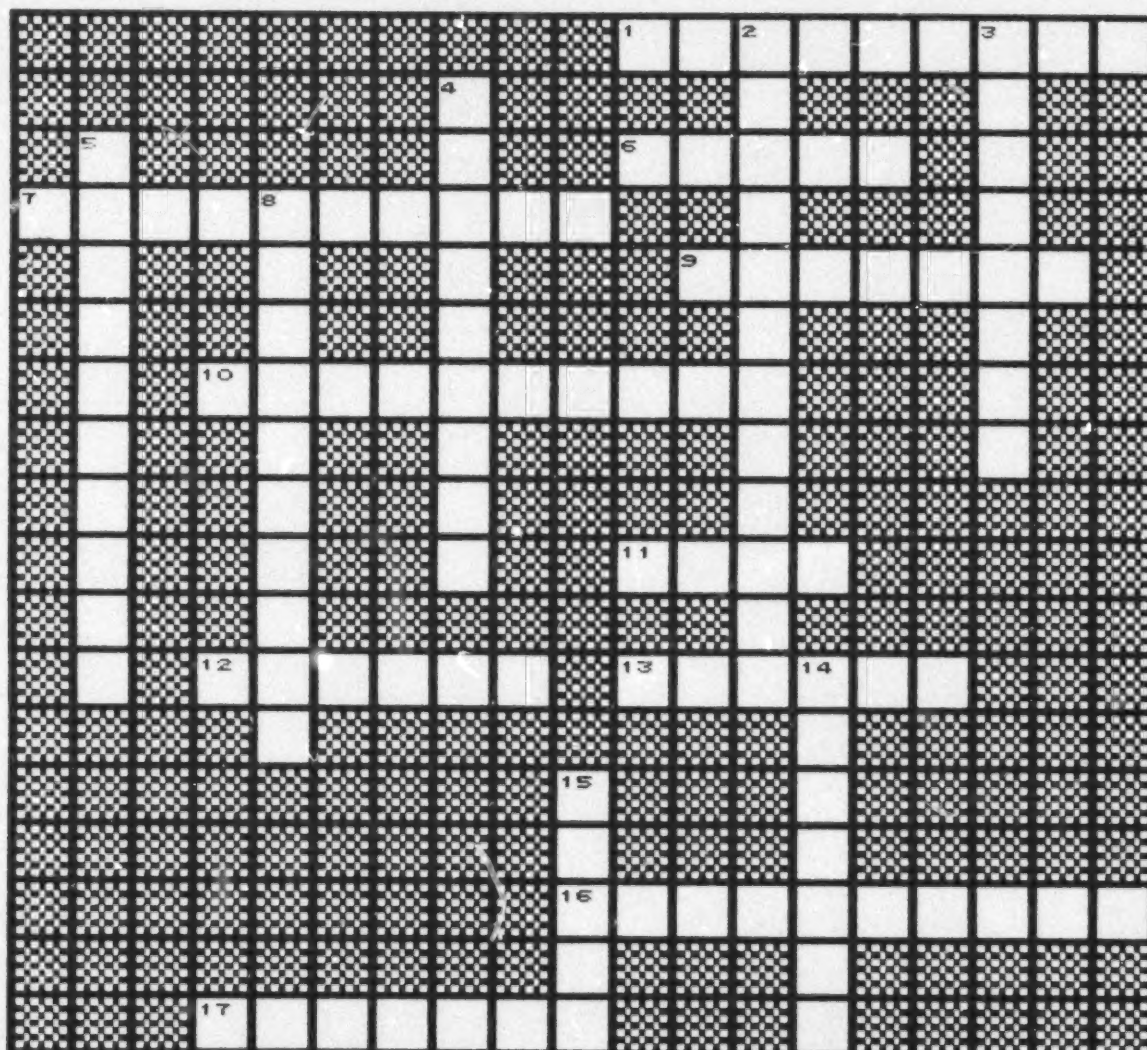
GRADE 8 PROJECTS AND FIELD TRIPS

To be used with part IB of the eighth grade syllabus:

1. Locate a place where programming is done (i.e. a university or business) and ask what programming languages are used and why. What seems to be the major factor in choosing a language? Describe the type of application. Are the languages supplied by the computer manufacturer? What speed does the computer run the language?
2. Ask a programmer what his/her job is like. How much of each of the following does he/she do?
 - a. programming
 - b. debugging
 - c. writing instructions for people
 - d. meeting with people
 - e. working with other people's programs

To be used with part IC of the eighth grade syllabus:

1. Visit a local computer store. Tell the salesperson that you are making a class report on the kinds of computers and computer equipment available. Ask him/her to show you the various types of computers. Ask where the CPU is. Ask to see various types of peripheral devices and what types of machines can use them.
2. Visit a local arcade and observe the types of computer, video games. What do they have in common? What kinds of input and output devices do they have? What type of format? Are they mostly target shooting, race car driving, or what?



ACROSS CLUES

1. A large computer where millions of instructions are executed each minute.
6. Computer language most commonly used in schools.
7. A billionth of a second.
9. A set of instructions for the computer to follow.
10. The unit in the computer where calculations take place.
11. Something that will cause certain steps in a program to be repeated as many times as you wish.
12. A type of computer that measures changing conditions, such as temperature, heartbeat, etc..
13. A versatile computer language named after the famous mathematician Blaise Pascal.
16. The language of the computer.
17. A type of computer that performs calculations by counting.

DOWN CLUES

2. What a program is made up of.
3. The 0's and 1's of the computer.
4. A representation of instructions for performing a task.
5. What a spot on a disk is.
8. A division of a program that performs a particular task.
14. The unit that directs the flow of information through the computer.
15. COmmon Business Oriented Language.

COMPUTER LIT (8)

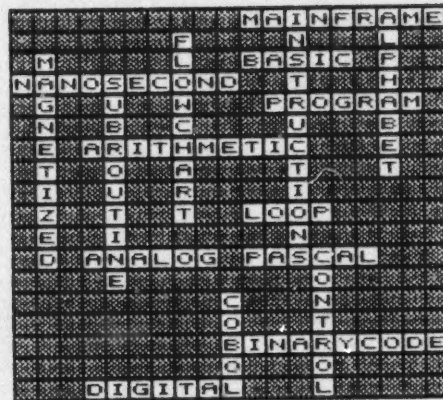
K X M L I K T R P I N J X V H V Q R N N
M V W L N U C A Q K O H T U I S O A E N
Q P Q R S Y X I S E H S Z M M C O L P N
X B W R T C V G T D N O L Y P R G P T S
J B Z N R J I I Q S X I Z O J I M H H E
H A M P U L V T F J Y W T E O A J A G Q
U S S T C N E O E A E O B U G P C B I W
N I X P T B Z F Y M T V J N O W E E L U
A C S M I I V K G D H H E H F R G T Q L
R M F B O I A T S M J T L T T X B Y T O
T F M R N T W O C N I I I G I A B U U R
R Q A G S I P L V Z A S N R B C L Y S T
O U R O E R V T E P B N S I A R X W O N
F X F L Y C K D R E F L O W C H A R T O
B I N A R Y C O D E R L C S E Z E N L C
J S I N D I G I T A L A E K E X H O S O
X Z A A I R P M Z F D C Z Q R C B Z I P
N C M L A G W D N T X S N S N O O D L E
Z D X M J B O L R B I A Z A C F L N A F
U M F O M W M A J S W P M C F M S H D C

THERE ARE 20 WORDS HERE - CAN YOU
FIND THEM?

HERE ARE THE WORDS TO LOOK FOR:

ALPHABET	ANALOG
ARITHMETIC	BASIC
BINARYCODE	COBOL
CONTROL	DIGITAL
FLOWCHART	FORTRAN
INSTRUCTIONS	JOYSTICK
LIGHTPEN	LOOP
MAGNETIZED	MAINFRAME
NANOSECOND	PASCAL
PROGRAM	SUBROUTINE

ANSWERS: COMP LIT (8)



COMP LIT (8)

[illegible]

GRADE 8 - I PRETEST

COMPUTER ORGANIZATION AND OPERATION

Name _____

- ___ 1. A computer program is a detailed, step by step, set of instructions.
A. true B. false
- ___ 2. All computers understand the same language.
A. false B. true
- ___ 3. Computer instructions are called commands.
A. true B. false
- ___ 4. BASIC is the only computer language.
A. true B. false
- ___ 5. Binary code is a nickname for the Morse code.
A. false B. true
- ___ 6. All programs must be typed on the keyboard in binary code.
A. false B. true
- ___ 7. Information from disks can be read into the computer memory.
A. false B. true
- ___ 8. Joysticks and paddles are examples of input units.
A. false B. true
- ___ 9. CPU stands for central processing unit.
A. false B. true
- ___ 10. The CPU is where arithmetic calculations take place.
A. false B. true
- ___ 11. A computer takes 5 seconds to calculate $26,529 \times 629,104,888$.
A. true B. false
- ___ 12. A thermometer is an example of an analog computer.
A. true B. false
- ___ 13. A speedometer is an example of a digital computer.
A. false B. true
- ___ 14. In most homes, the type of computer you will find is a mainframe.
A. true B. false
- ___ 15. Microcomputers are the type used in most schools.
A. true B. false

GRADE 8 - 11 PRETEST

LIMITATIONS

Name _____

- ___ 1. It is easy to find good, usable software.
A. false B. true
- ___ 2. All computers have the same storage capacity.
A. false B. true
- ___ 3. Computers are only capable of carrying out instructions given to it by the programmer.
A. true B. false
- ___ 4. Computers are capable of generating their own problems.
A. false B. true
- ___ 5. All computer records are well-protected for personal privacy.
A. true B. false

FLOWCHARTING AND PROBLEM SOLVING

Name _____

- ___ 1. Flowcharts are never linear.
A. false B. true
- ___ 2. A loop takes you immediately to the end of the problem.
A. true B. false
- ___ 3. A subroutine can make a complex problem easier to follow.
A. true B. false
- ___ 4.  is a decision box.
A. false B. true
- ___ 5. A flowchart can have five or more starting places.
A. true B. false
- ___ 6. Flowcharts may end in more than one place.
A. false B. true

COMPUTER ORGANIZATION AND OPERATION

Name _____

1. _____ is the first step in the problem solving process.
- A. Look back
 - B. Understand the problem
 - C. Formulate a solution plan
 - D. Carry out the plan
2. Which equation would you use to solve the following problem: If the price of 12 oranges is \$1.44, how much does each orange cost?
- A. $1.44 - 12$
 - B. $1.44 / 12$
 - C. $1.44 + 12$
 - D. 1.44×12
3. A computer program is:
- A. a detailed, step by step, set of instructions.
 - B. a television show about computers.
 - C. a list of instructions to the computer operator.
 - D. about the same thing as a flowchart.
4. BASIC is an example of:
- A. an all purpose language.
 - B. a natural language.
 - C. a language most often used in business applications.
 - D. a language all computers understand.
5. Cobol is an example of:
- A. a language used for video games.
 - B. a language better suited to business applications.
 - C. an all purpose language.
 - D. a mathematic/scientific language.
6. The binary code is:
- A. another name for the Morse code.
 - B. a system of numbers using the digits 0,1,2, and 4.
 - C. the way all data is entered into the computer.
 - D. the 'alphabet' of the computer.
7. Which is NOT a type of input device?
- A. printer
 - B. lightpen
 - C. paddle
 - D. keyboard
8. Which of the following abbreviations is NOT commonly used in computer science?
- A. CRT
 - B. ECT
 - C. CPU
 - D. RAM
9. The CPU:
- A. writes programs for large businesses.
 - B. is a type of secondary storage.
 - C. interprets instructions to the computer.
 - D. generates problems for the computer to solve.
10. Which is NOT a part of the CPU?
- A. arithmetic unit
 - B. memory
 - C. control unit
 - D. graphics tablet

GRADE 8 - I POSTTEST
Page 2

COMPUTER ORGANIZATION AND OPERATION

11. Which of the following is a function of the arithmetic unit?
A. controlling the flow of information
B. comparing numbers
C. storing information
D. sending information to the output device to be displayed
12. A nanosecond is:
A. one billionth of a second. C. five seconds.
B. one minute. D. one tenth of a second.
13. A thermostat is an example of:
A. a microcomputer. C. a digital computer.
B. a process control device. D. an analog computer.
14. Digital computers work on information:
A. physically. C. mathematically.
B. alphabetically. D. none of the others.
15. A specific purpose computer:
A. has only one application.
B. is used for anything from budgeting to word processing.
C. can perform a variety of tasks.
D. has a large memory and accepts more peripherals.
16. Which of the following is NOT true about microcomputers?
A. They can perform calculations.
B. They are relatively inexpensive.
C. They can be found in schools.
D. They can execute millions of instructions a second.
17. A _____ has a complex system of storage devices which allows great quantities of data to be available.
A. microcomputer C. analog computer
B. minicomputer D. mainframe computer
18. An algorithm is:
A. a computer language.
B. a technical name for a computer program.
C. a set of steps needed to solve a specific problem.
D. a specific type of flowchart.
19. Which is NOT a step in understanding a problem?
A. Determine the given.
B. Find out what the problem is asking for.
C. Read the problem slowly.
D. Write the equation.
20. A typical computer understands:
A. 10 commands. C. 0 - 100 commands.
B. 100 - 200 commands. D. 200 - 300 commands.

LIMITATIONS

Name _____

1. A task quite suited to a computer is:
- A. to print out 'personalized' form letters for advertising purposes
 - B. to take off, pilot, and land a small plane.
 - C. to take over most functions currently performed by teachers.
 - D. to analyze an X-ray and recommend a course of treatment for a disease.
2. When we say a computer 'understands' instructions we mean:
- A. it can print out definitions of the instructions.
 - B. the computer can execute the instructions.
 - C. the computer can explain the meaning of the instructions.
 - D. the computer's keyboard has a key corresponding to those instructions.
3. Most things computers do:
- A. can be done in other ways.
 - B. can be done more reliably by hand.
 - C. can only be done by computers.
 - D. can be done more cheaply if large computers are used.
4. At the current time computers are:
- A. taking over most functions of a first grade teacher.
 - B. handling most of the administrative work in secondary schools.
 - C. running small real estate businesses.
 - D. becoming commonplace in medical education.
5. Large scale or national data banks are not a threat to privacy because:
- A. they are prohibited by law.
 - B. truth cannot hurt people.
 - C. none of the others.
 - D. they are used only for our benefit.
6. In solving a problem a computer:
- A. first has to understand the problem.
 - B. usually recalls the answer from memory.
 - C. follows a program, written by people.
 - D. thinks like a person.
7. A good way to think about computers is:
- A. computers cannot make mistakes.
 - B. computers are built and programmed by people.
 - C. anything a human can do, a computer can do better.
 - D. it is impossible for a computer to tell a lie.
8. A computer is:
- A. smarter than humans.
 - B. capable of generating its own problems.
 - C. extremely slow.
 - D. incapable of anything more than carrying out instructions.
9. Which is NOT a drawback in using computers?
- | | |
|---------------------|-----------------------------|
| A. expense | C. speed |
| B. storage capacity | D. availability of software |

LIMITATIONS

10. Which is NOT a criteria for practical use of a computer?
- A. The data needed, can be obtained and fed into the computer.
 - B. There is already a program written to solve the problem.
 - C. The computer must be fast enough to make its use worthwhile.
 - D. The use of the computer is justified by saving time, money, or energy.

GRADE 8 - 111 POSTTEST

FLOWCHARTING AND PROBLEM SOLVING

Name _____

1. A linear flowchart:
- A. is easy to use with longer problems.
 - B. contains at least one loop.
 - C. goes from left to right.
 - D. goes from top to bottom without backtracking.
2. A flowchart is best defined as:
- A. a chart or record showing weekly flow of programs through a computer.
 - B. a two-dimensional picture showing a step by step set of instructions.
 - C. a computer-produced analysis of the steps needed to solve a problem.
 - D. a diagram showing the flow of electricity through a computer.
3. A  indicates a:
- | | |
|-----------------------------|------------------|
| A. set of instructions. | C. decision. |
| B. read or write statement. | D. start or end. |
4. A loop will:
- A. cause certain steps in the problem to be done over and over again.
 - B. confuse the computer.
 - C. run from top to bottom without backtracking.
 - D. take you out of the problem and bring you back in at the same place.
5. A subroutine:
- A. reminds you of what the flowchart is for.
 - B. is an extra part added into the flowchart.
 - C. finishes the problem outside of the flowchart.
 - D. divides a task into 2 or more smaller parts.

GRADE 8 - I PRETEST

Numbered Answer Key

1	A	2	A	3	A	4	B
5	A	6	A	7	B	8	A
9	B	10	B	11	B	12	A
13	A	14	B	15	A		

GRADE 8 - II PRETEST

Numbered Answer Key

1	A	2	A	3	A	4	A
5	B						

GRADE 8 - III PRETEST

Numbered Answer Key

1	A	2	B	3	A	4	B
5	B	6	B				

GRADE 8 - I POSTTEST

Numbered Answer Key

1	B	2	B	3	A	4	A
5	B	6	D	7	A	8	B
9	C	10	D	11	B	12	A
13	D	14	C	15	A	16	D
17	D	18	C	19	D	20	A

GRADE 8 - II POSTTEST

Numbered Answer Key

1	A	2	B	3	A	4	D
5	C	6	C	7	B	8	F
9	C	10	B				

GRADE 8 - III POSTTEST

Numbered Answer Key

1	D	2	B	3	D	4	A
5	D						

PROGRAMMING

GRADE 7

PROGRAMMING

This unit consists of instructions in elementary programming in BASIC computer language. An attempt has been made to make this unit applicable to any computer. If the class has access to Apple computers, please refer to the HTRAC book, chapters 5-7, for more detailed instructions in Apple BASIC (Applesoft). Much of this unit is modified from the HTRAC book.

I. SEVENTH GRADE

A. The PRINT Command

We begin with programs that will write something on the screen.

A program is a series of instructions telling the computer what to do. The instructions are given to the computer line by line. Since the computer follows instructions in numerical order, each line of the instructions is numbered, generally by multiples of 10. This allows ample space to insert statements between the lines with multiples of 10. It is proper to make the last line of any program END.

The word used to tell the computer to write something on the screen is PRINT. The word, number, or sentence that you want to print must be in quotes and placed after the word PRINT. The following program will have the computer print GOOD MORNING on the screen:

```
10 PRINT "GOOD MORNING"  
20 END
```


After each line is typed, the RETURN key must be pressed to tell the computer that you are finished with that line. For the remainder of this unit, it is assumed that the RETURN key is pressed after each line. To run the above program, type RUN and press RETURN. The message GOOD MORNING should appear on the screen.

It is often useful to see what you typed for your program. Type LIST and press RETURN. This will display the program that you last typed.

This next program will display the message MY LUCKY NUMBER IS on one line and 13 on the following line.

```
10 PRINT "MY LUCKY NUMBER IS"  
20 PRINT "      13"  
30 END
```

Notice that the 13 begins under the Y in LUCKY. This is because several spaces were typed between the first quote and the 13. If no spaces were typed, the 13 would begin under the M in MY.

Add this line to the last program:

```
15 PRINT
```

This will instruct the computer to insert line 15 in the program between lines 10 and 20. When the program is RUN, there is an extra line between MY LUCKY NUMBER IS and 13. PRINT with nothing following will skip a line.

In summary, PRINT will display any message on the screen but that message must be in quotes. RUN will run the program. LIST will display the last program you typed. END is the last line in most programs.

SUGGESTED EXERCISES:

1. Write a program that prints the message THIS IS EASY on the screen.
2. Write a program that prints your name on one line and your address on the next line.
3. Write a program that will print three names on three separate lines with blank lines between the names.

B. Calculations

The computer may be used as an expensive calculator. The word PRINT is used before any calculations. The following program will calculate 345 plus 546:

```
10 PRINT 345+546
20 END
```

The computer will display the answer of 891 when the program is RUN.

Some of the symbols on the computer are different. The + and - are still used for addition and subtraction. For multiplication use *. Thus, 8×7 is written as $8 * 7$. For division, use /. Thus, 24 divided by 8 is written as $24 / 8$. Exponent symbols vary, depending on the computer. (Check the manual to see what symbol is used.) A common exponent symbol is ^. Thus, 2 to the third power ($2 * 2 * 2$) is written as 2^3 .

The following program prints the sum, difference, product, and quotient of 8 and 4 and 2 to the third power.

```
10 PRINT 8+4
20 PRINT 8-4
30 PRINT 8*4
```

```
40 PRINT 8/4
50 PRINT 2^3
60 END
```

After the program is RUN, the results would be:

```
12
4
32
2
8
```

Please note the difference in using quotes after PRINT.

```
10 PRINT "10+5"
20 PRINT 10+5
30 END
```

In line 10, the computer prints 10+5 while, in line 20, the computer prints 15.

SUGGESTED EXERCISES:

1. Write a program that will add, subtract, multiply, and divide 15 and 3.
2. Write a program that will raise 8 to the second power.
3. Write a program that will use +, -, *, /, and ^ at least once.

C. Order of Operations

The computer does not always do mathematical operations from left to right. For example, the answer that is obtained from running the following program is 17 (not 27).

```
10 PRINT 5+4*3
20 END
```

Computers follow specific rules in their calculations, called order of operations. The rules are as follows:

1st--Calculate anything in parenthesis.

2nd--Calculate any exponents.

3rd--Calculate multiplication and division.

4th--Calculate addition and subtraction.

These operations are all done from left to right.

A computer would calculate $40-8/2+2*1^3$ as follows:

$$40-8/2+2*1^3=$$

$$40-8/2+2*1=$$

$$40-4+2*1=$$

$$40-4+2=$$

$$36+2=$$

$$38$$

The answer to the following problem is 6.

$$(1+2)*4^2/(9-(2-1))=$$

$$3*4^2/(9-(2-1))=$$

$$3*4^2/(9-1)=$$

$$3*4^2/8=$$

$$3*16/8=$$

$$48/8=$$

$$6$$

See what you would obtain from the following program:

```
10 PRINT 3+2*4^2
```

```
20 PRINT (3+2)*4^2
```

```
30 PRINT 3+(2*4)^2
```

```
40 PRINT ((3+2)*4)^2
```

```
50 END
```


You would obtain a 35 from line 10, an 80 from line 20, a 67 from line 30, and a 400 from line 40.

SUGGESTED EXERCISES:

1. Write a program to compute $8*12/3-2*5$. (ans. 22)
2. Write a program compute $8*12/(3-2)*5$. (ans. 480)
3. Write a program, inserting parentheses where needed, so that $5*24-2/1+1$ will equal 55.
4. Write a program, inserting parentheses where needed, so that $96/24/2$ equals 8 and $96/24/2$ equals 2.
5. Write a program that evaluates $10-2^3$ and $(10-2)^3$.
6. Write a program to show that subtraction is not associative by one counter-example.
7. Write a program using four fours and +, -, *, /, or ^ to get values of 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. An example on how to get 8 is:

```
10 PRINT ((4*4)-4)-4
20 END
```

D. The LET Command

A variable is a letter that stands for a number. The letter X is often used as a variable. The value of X might be 2 or it might be 27. It could be anything! Its value can vary. This is why it is called a variable.

The instruction to the computer that assigns a number to a variable is a LET statement. The following program assigns the value of $10+5$ to H, then it prints the value of H (15).


```
10 LET H=10+5
20 PRINT H
30 END
```

Notice that line 20 does not print H, but the value assigned to H which is 15. When PRINT is used without quotes, the value of the variable following the PRINT is displayed.

To separate variables when more than one is used, commas and semicolons are employed. Both are used in the following program:

```
10 LET A=10
20 LET B=15
30 LET C=A+B
40 PRINT A;B;C
50 PRINT A,B,C
60 END
```

Line 40 will cause 10, 15, and 25 to be printed close together, while line 50 causes these three numbers to be printed with spaces between. The exact format created by using commas and semicolons varies according to the computer. Check your computer's manual for this format.

The PRINT command can be used to combine messages and variables as shown in the following two programs:

```
10 LET G=9
20 LET J=3
30 PRINT "G DIVIDED BY J IS ";G/J
40 END
```

Notice that line 30 causes the message 'G DIVIDED BY J IS' to be displayed followed by the value of the variable G/J which is 9/3 or 3.

```

10 LET Q=25
20 LET P=35
30 PRINT "THE SUM OF ";Q;" AND ";P;" IS ";Q+P
40 END

```

Line 30 will display 'THE SUM OF', then the value of Q (25), then 'AND', then the value of P (35), then 'IS', and then the value of Q+P (25+35 or 60). It will look like:

THE SUM OF 25 AND 35 IS 60

SUGGESTED EXERCISES:

1. Write a program that assigns 28 and 36 to variables and then adds them.
2. Write a program that assigns 985 and 637 to variables and then multiplies them.
3. Write a program that uses LET, PRINT, and END statements and either semicolons or commas in the PRINT statement(s).
4. Write a program that will average five numbers of your choice.

E. The INPUT Command

It is often convenient to allow a program to ask for a number. INPUT tells the computer to wait until something has been typed in. A variable must follow the word INPUT. The next program uses INPUT to square any number that is typed in.

```

10 PRINT "WHAT IS THE NUMBER THAT YOU WANT TO SQUARE?"
20 INPUT N
30 LET S=N*N
40 PRINT S;" IS THE SQUARE OF ";N
50 END

```

The computer will first print:

WHAT IS THE NUMBER THAT YOU WANT TO SQUARE?

Then a question mark will appear to indicate that you are to type in a number. When you hit the RETURN key after typing the number, the computer will assign this number to the variable N. The program then continues.

You may request more than one number at a time with one INPUT statement. Commas must be used to separate the variables. Notice this usage in the next program, which will average any three numbers.

```
10 PRINT "WHAT ARE YOUR THREE NUMBERS?"
20 INPUT X,Y,Z
30 LET A=(X+Y+Z)/3
40 PRINT "THE AVERAGE IS ";A
50 END
```

The computer will not move past line 20 until three numbers have been typed in and the first number assigned to the variable X, the second to Y, and the third to Z.

SUGGESTED EXERCISES:

1. Write a program that will calculate the perimeter of a square. The program should ask for the length of a side and output the perimeter.
2. Bill works for \$3.50 an hour. Write a program that tells how much he will be paid for any amount of hours worked. The program should ask for the number of hours worked and output the amount of pay.

3. Write a program that will calculate the area of a rectangle. The program should ask for the length and width of the rectangle and output the area.
4. Mr. Teacher always gives 6 tests each marking period. Write a program to help him find averages easily.
5. Write a program to convert from Celsius to Fahrenheit by using the formula $F = C * 9 / 5 + 32$ or from Fahrenheit to Celsius by using the formula $C = (F - 32) * 5 / 9$.
6. Write a program that will calculate miles per gallon for a car. The program will ask for the miles driven and the gallons used.
7. Write a program that modifies Exercise 6 so that miles per gallon will be calculated from two odometer readings and the gallons used.
8. Write a program that will tell the cost of an item after a discount. The program should ask for the original price and the percent of discount. Example: If a \$60 item was sold at a 15% discount, the discount would be $60 * .15$ or 9 and the sales price would be $60 - 9$ or 51.

ANSWERS FOR SUGGESTED EXERCISES

Sample answers for all the suggested exercises follow. Please remember that there are several ways to answer many of these exercises. Answers may vary greatly. There is no one correct answer.

7-A The PRINT Command

1. 10 PRINT "THIS IS EASY"
 20 END
2. 10 PRINT "JOHN ELWAY"
 20 PRINT "DENVER, COLORADO"
 30 END
3. 10 PRINT "FRANK"
 20 PRINT
 30 PRINT "LLOYD"
 40 PRINT
 50 PRINT "WRIGHT"
 60 END

7-B Calculations

1. 10 PRINT 15+3
 20 PRINT 15-3
 30 PRINT 15*3
 40 PRINT 15/3
 50 END
2. 10 PRINT 8^2
 20 END
3. 10 PRINT 1+1
 20 PRINT 2-1
 30 PRINT 1*20
 40 PRINT 20/5
 50 PRINT 4^3
 60 END

7-C Order of Operations

1. 10 PRINT 8*12/3-2*5
 20 END
2. 10 PRINT 8*12/(3-2)*5
 20 END

```

3.    10 PRINT 5*(24-2)/(1+1)
      20 END

4.    10 PRINT 96/(24/2)
      20 PRINT (96/24)/2
      30 END

5.    10 PRINT 10-2^3
      20 PRINT (10-2)^3
      30 END

6.    10 PRINT (10-6)-2
      20 PRINT 10-(6-2)
      30 END

7.    10 PRINT (4-4)+(4-4)
      20 PRINT 4+(4/4)-4
      30 PRINT (4/4)+(4/4)
      40 PRINT (4+4+4)/4
      50 PRINT ((4-4)/4)+4
      60 PRINT ((4*4)+4)/4
      70 PRINT ((4+4)/4)+4
      80 PRINT (4+4)-4/4
      90 PRINT (4/4*4)+4
     100 PRINT (4+4)+4/4
     110 END

```

7-D The LET Command

```

1.    10 LET S=28
      20 LET V=36
      30 PRINT S+V
      40 END

2.    10 LET R=985
      20 LET G=637
      30 PRINT R*G
      40 END

3.    10 LET A=20
      20 LET B=30
      30 LET C=40
      40 PRINT "A+B= ";A+B
      50 PRINT "B TIMES C = ",B*C
      60 END

4.    10 LET Q=60
      20 LET R=70
      30 LET S=80
      40 LET T=90
      50 LET U=100
      60 LET V=(Q+R+S+T+U)/5
      70 PRINT "THE AVERAGE IS ";V
      80 END

```

7-E The INPUT Command

1. 10 PRINT "WHAT IS THE SIDE OF THE SQUARE?"
 20 INPUT S
 30 LET P=4*S
 40 PRINT "THE PERIMETER IS ";P
 50 END
2. 10 PRINT "HOW MANY HOURS WORKED?"
 20 INPUT H
 30 LET W=H*3.50
 40 PRINT "BILL EARNED \$";W
 50 END
3. 10 PRINT "WHAT IS THE LENGTH?"
 20 INPUT L
 30 PRINT "WHAT IS THE WIDTH?"
 40 INPUT W
 50 LET A=L*W
 60 PRINT "THE AREA IS ";A
 70 END
4. 10 PRINT "TYPE THE GRADE FOR TEST 1."
 20 INPUT A
 30 PRINT "TYPE THE GRADE FOR TEST 2."
 40 INPUT B
 50 PRINT "TYPE THE GRADE FOR TEST 3."
 60 INPUT C
 70 PRINT "TYPE THE GRADE FOR TEST 4."
 80 INPUT D
 90 PRINT "TYPE THE GRADE FOR TEST 5."
 100 INPUT E
 110 PRINT "TYPE THE GRADE FOR TEST 6."
 120 INPUT F
 130 LET G=(A+B+C+D+E+F)/6
 140 PRINT "THE AVERAGE IS ";G
 150 END
5. 10 PRINT "WHAT IS THE CELSIUS TEMPERATURE?"
 20 INPUT C
 30 LET F=C*9/5+32
 40 PRINT "THE FAHRENHEIT TEMPEPATURE IS ";F
 50 END
6. 10 PRINT "HOW MANY MILES DRIVEN?"
 20 INPUT M
 30 PRINT "HOW MUCH GAS USED?"
 40 INPUT G
 50 LET A=M/G
 60 PRINT "YOUR MILES PER GALLON IS ";A

```
7. 10 PRINT "FIRST ODOMETER READING?"
    20 INPUT F
    30 PRINT "SECOND ODOMETER READING?"
    40 INPUT S
    50 LET M=S-F
    60 PRINT "HOW MUCH GAS USED?"
    70 INPUT G
    80 LET A=M/G
    90 PRINT "YOUR MILES PER GALLON IS ";A
    100 END

8. 10 PRINT "WHAT WAS THE ORIGINAL PRICE?"
    20 INPUT O
    30 PRINT "WHAT PERCENT IS THE DISCOUNT?"
    40 INPUT D
    50 LET A=O*D
    60 LET S=O-A
    70 PRINT "THE DISCOUNT IS ";A
    80 PRINT "THE SALES PRICE IS ";S
    90 END
```


QUIZ FOR PROGRAMMING - SEVENTH GRADE

At the completion of the seventh grade unit, students should be able to pass this quiz.

1. A series of instructions telling the computer what to do is called a _____.
2. It is proper to end a program with an _____ statement.
3. Each line of a program is _____ since the computer follows instructions in numerical order.
4. To display a message on the screen, a _____ statement must be used.
5. The symbol for multiplication on the computer is _____.
6. PRINT followed by _____ will skip a line.
7. The message to be printed in a PRINT statement must be in _____.
8. The symbol for division on the computer is _____.
9. T or F. The output for line 10 would be 13.
10 PRINT "10+3" _____
10. The value of $20-4*2$ is _____.
11. The value of $30/2-2^3$ is _____.
12. For the expression $5+4*3^2$, what will the computer do first?
1 4*3
2 3^2
3 5+4 _____
13. You must use _____ if you want the value of $30+10/5$ to be 8.
14. A letter that stands for a number is called a _____.
15. The instruction that assigns a number to a letter is a _____ statement.
16. To separate letters when one or more are used in a statement, commas and _____ are employed.
17. To allow a program to ask the operator for a number, an _____ statement is used.

18. To start the execution of a program, use the command _____.
19. Type the command _____ to see the entire program that you typed on the screen.
20. A _____ must follow INPUT in an INPUT statement.
21. T or F. It is possible to request more than one number with one INPUT statement. _____
22. T or F. The following program will display the message STAR WARS on the screen.
10 PRINT STAR WARS _____
23. The symbol ^ is used to represent an _____.
24. What will the following program print for line 10?
10 PRINT 45-30 _____
25. The symbol that will appear on the screen when the computer operator is to input a number during an INPUT statement is a _____.

ANSWERS

- | | | |
|-------------|-----------------|-------------------|
| 1. program | 10. 12 | 18. RUN |
| 2. END | 11. 7 | 19. LIST |
| 3. numbered | 12. 2 | 20. variable |
| 4. PRINT | 13. parenthesis | 21. T |
| 5. * | 14. variable | 22. F |
| 6. nothing | 15. LET | 23. exponent |
| 7. quotes | 16. semicolons | 24. 15 |
| 8. / | 17. INPUT | 25. question mark |
| 9. F | | |

PROGRAMMING

GRADE 8

II. EIGHTH GRADE

A. Alphanumeric Variables

So far, variables have been for numbers only. However, we can assign words, letters, or any characters to a special type of variable called an alphanumeric variable (sometimes called a string variable). When you want to input a letter, word, character, or combination of these into a program, you must use an alphanumeric variable. The symbols used for alphanumeric variables are letters followed by a \$. Some examples are: A\$, M\$, or Y\$.

Anything assigned to an alphanumeric variable must be in quotes as seen in the following program.

```
10 LET C$="COMPUTER WIZARD"
20 PRINT "I AM A ";C$
30 END
```

In this program, the words COMPUTER WIZARD are assigned to the alphanumeric variable C\$. The output looks like:

```
I AM A COMPUTER WIZARD
```

The next program allows for input of any word, letter, or character.

```
10 PRINT "WHAT IS YOUR NAME?"
20 INPUT N$
30 PRINT "HELLO ";N$
40 END
```

This program has two INPUT statements:

```
10 PRINT "WHAT IS YOUR NAME?"
20 INPUT N$
```



```
30 PRINT "HOW OLD ARE YOU?"
40 INPUT N
50 PRINT "IN TEN YEARS ";N$;" WILL BE ";N+10;" YEARS OLD?"
60 END
```

Please note the difference between N and N\$. N\$ is an alphanumeric variable and N is a variable that may only be assigned numbers (numeric). A word like Joe or Bob may not be assigned to N.

The value of alphanumeric variables can be seen in the next program. This program will print a short grade report.

```
10 PRINT "WHAT IS THE STUDENT'S NAME?"
20 INPUT N$
30 PRINT "WHAT IS THE SUBJECT?"
40 INPUT S$
50 PRINT "WHAT WAS THE GRADE?"
60 INPUT G
70 PRINT "DEAR ";N$;","
80 PRINT
90 PRINT "IN THE PAST TEN WEEKS YOUR GRADE FOR"
100 PRINT S$;" WAS ";G;". "
110 PRINT
120 PRINT "YOUR LOVING TEACHER"
130 END
```

Notice that two alphanumeric variables (N\$ and S\$) and the variable G were used. Remember that lines 80 and 110 will cause the computer to skip a line. To begin this letter at the top of the screen, a command to clear the screen should be placed between lines 60 and 70. This command varies among computers. Check your

computer's manual for the correct command. This is a good program to run several times with different variable assignments. This is the basic format for any form letter.

Although alphanumeric variables are used mainly for words, they may also save numbers. This is useful for social security numbers, dates, etc. An alphanumeric variable like S\$ will accept, in an INPUT statement, a social security number typed as 021982176 or as 021-98-2176 while a variable like S will not accept 021-98-2176.

SUGGESTED EXERCISES:

1. Write a program using alphanumeric variables that will print a simple message.
2. Write a program requesting a name to be input. The output should be a statement including the requested name.
3. Write a form letter to explain why your homework is not done on time. Variables should include your teacher, the date, and the reason.
4. Write any form letter that requires the user to input their social security number and prints this number in the letter.
5. You are having a party. Write a program that will output an invitation for this party. The invitation should include the date, the time, the place, and the reason for the party. Variables should include the guest and the guest's address.

B. READ and DATA Statements

Words and numbers may be entered by two methods so far: LET statements such as LET A=5 or LET E\$="EVA" and INPUT statements

such as INPUT D or INPUT D\$. READ and DATA statements are a third way. Whenever the computer finds a READ statement, it immediately looks for a DATA statement. The DATA statement contains the data that is assigned to the variable(s) after the READ statement. The next program uses READ and DATA.

```
10 READ A,B
20 PRINT A+B
30 DATA 5,10
40 END
```

When this program is RUN, the computer will print 15. The DATA statement assigns 5 to the variable A and 10 to the variable B.

There may be more than one READ for one DATA statement. The READ statements use the values in the DATA statements one by one, consecutively, from first to last. You may have more data in the DATA statements than variables in the READ statements. Less data than variables will cause an error. You may also have more DATA statements than READ statements.

```
10 READ A,B
20 PRINT B-A
30 READ C,D,E
40 PRINT C*D+E+B-A
50 DATA 1,4,5,20,10
60 END
```

The output would be 3 and 1003.

READ and DATA can be used with alphanumeric variables.

```
10 READ N$,G$
20 PRINT N$
```



```
30 PRINT G$
40 DATA "DEBBIE","ELEVENTH GRADE"
50 DATA "HOMEROOM 122"
60 END
```

Notice that there are two alphanumeric variables after READ statements and three sets of data after DATA statements. DEBBIE will be assigned to N\$ and ELEVENTH GRADE will be assigned to G\$ but HOMEROOM 122 will not be assigned to a variable. This will not cause an error but another alphanumeric variable must be READ or line 50 is not necessary in this program.

SUGGESTED EXERCISES:

1. Write a program using the READ and DATA statements that will add the numbers 3, 7, and 10.
2. Write a program using READ and DATA statements that will add 4 and 6, multiply 3 and 12, and divide 15 by 5.
3. Write a program using the READ and DATA statements that will print your name and address.

C. Loops using GOTO

One of the major differences between a calculator and a computer is the computer's ability to do the same thing over and over again an outrageous number of times. This is called a loop. One way to make a loop is to use a GOTO statement.

GOTO is used in this program:

```
10 PRINT "MY COMPUTER IS OUT OF CONTROL!"
20 GOTO 10
30 END
```


If you RUN this program, the computer will print the message in line 10 over and over again, until you stop it. This is a continuous loop. The method to stop this program varies among computers. Check your manual for the correct method. Of course, you may always stop any program by turning off the computer, but this will erase the program from the computer's memory.

GOTO statements cause the computer to execute the line that follows GOTO. In the last program, line 20 tells the computer to go back and do line 10. After executing line 10, the computer goes to line 20 which directs it back to line 10. This continues until stopped.

See if you can follow what happens in this next example.

```
10 GOTO 40
20 PRINT "GOODBYE"
30 GOTO 20
40 PRINT "HELLO"
50 GOTO 30
60 END
```

When RUN, this will print HELLO once and GOODBYE until you stop it. Line 10 sends the computer to line 40 and prints HELLO. It next goes to line 50 which sends it to line 30 then to line 20 to print GOODBYE. The computer is then in a continuous loop between lines 20 and 30. This program is only used as an example and does not demonstrate good programming technique as it could be done more simply as follows:

```
10 PRINT "HELLO"
20 PRINT "GOODBYE"
```

```
30 GOTO 20
```

```
40 END
```

SUGGESTED EXERCISES:

1. Write a program that will print the same message continuously until you stop the program.
2. Write a program that will alternately print GO and STOP on separate lines until you stop it.
3. Tell what the following program will do in a sentence or two.

```
10 PRINT "#1"
```

```
20 GOTO 80
```

```
30 PRINT "#3"
```

```
40 GOTO 60
```

```
50 PRINT "#4"
```

```
60 GOTO 90
```

```
70 GOTO 30
```

```
80 PRINT "#2"
```

```
90 GOTO 70
```

```
100 END
```

4. Rewrite the program in Exercise 3 so that it will do the same thing with only one GOTO statement.

D. Loops using FOR and NEXT

A second and more practical way to create loops are with FOR and NEXT statements. They are used in the next program to print something ten times.

```
10 FOR D=1 TO 10
```

```
20 PRINT "COMPUTERS ARE"
```

```
30 NEXT D
40 PRINT "GREAT"
50 END
```

In this program, COMPUTERS ARE is printed 10 times and GREAT is printed once before the program ends. As the program begins, the value of D is 1. It prints COMPUTERS ARE the first time. Line 30 increases D by one to 2, then goes to line 20 to print the message a second time. This pattern repeats until the message is printed ten times then the computer goes to line 40 and 50.

Any variable may be used in FOR and NEXT statements but it must be the same. Also, the variable need not start with 1.

```
10 FOR J=40 TO 55
20 PRINT J
30 NEXT J
40 END
```

This will print the integers from 40 to 55 inclusive. FOR and NEXT is often used with READ and DATA as follows:

```
10 FOR Y=1 TO 5
20 READ A
30 PRINT A
40 NEXT Y
50 DATA 9,11,13,17,22
60 END
```

The output would be a print out of the numbers 9, 11, 13, 17, and 22 in a vertical column.

The word STEP will allow you to skip numbers in FOR and NEXT statements. The following program will print the even integers from 110 to 140 inclusive.

```
10 FOR E=110 TO 140 STEP 2
20 PRINT E
30 NEXT E
40 END
```

STEP 2 indicates that E will be increased by 2 each time. If the 2 were changed to 5 in line 10, the program would print the multiples of 5 between 110 and 140. The number after STEP may also be negative. The next program will print the multiples of 3 from 60 to 0 inclusive.

```
10 FOR Q=60 TO 0 STEP -3
20 PRINT Q
30 NEXT Q
40 END
```

SUGGESTED EXERCISES:

1. Write a program that prints the numbers from 423 to 511 inclusive.
2. Write a program to write the multiples of 7 from 7 to 700 inclusive (use STEP).
3. Write a program that will print out a message exactly 13 times.
4. Write a program that will countdown from 20 to 0 and then print BLASTOFF!

ANSWERS FOR SUGGESTED EXERCISES

Sample answers for all the suggested exercises follow. Please remember that there are several ways to answer many of these exercises. Answers may vary greatly. There is no one correct answer.

8-A Alphanumeric Variables

1. 10 LET M\$="HOMEWORK IS FUN!"
 20 PRINT M\$
 30 END

2. 10 PRINT "WHAT IS YOUR NAME?"
 20 INPUT N\$
 30 PRINT "HELLO ";N\$
 40 END

3. 10 PRINT "TEACHER'S NAME?"
 20 INPUT T\$
 30 PRINT "THE DATE?"
 40 INPUT D\$
 50 PRINT "THE REASON?"
 60 INPUT R\$
 70 (Use the command to clear the screen)
 80 PRINT "DEAR ";T\$
 90 PRINT "MY HOMEWORK WAS NOT DONE ON ";D\$
 100 PRINT "BECAUSE ";R\$
 110 PRINT "YOUR LOVING STUDENT."
 120 END

4. 10 PRINT "TYPE YOUR SOCIAL SECURITY NUMBER."
 20 INPUT S\$
 30 (Use the command to clear the screen)
 40 PRINT "DEAR SIR:"
 50 PRINT " YOU ARE WANTED FOR MURDER AND J-WALKING"
 60 PRINT "IF YOUR SOCIAL SECURITY NUMBER IS ";S\$
 70 PRINT "REPORT YO JAIL."
 80 PRINT " THE POLICE"
 90 END

5. 10 PRINT "GUEST'S NAME?"
 20 INPUT G\$
 30 PRINT "GUEST'S ADDRESS?"
 40 INPUT A\$
 50 (Use the command to clear the screen)
 60 PRINT A\$
 70 PRINT
 80 PRINT "DEAR ";G\$
 90 PRINT "PLEASE COME TO A PARTY ON JULY 23 AT 8 PM."
 100 PRINT "IT IS AT MY HOUSE BECAUSE I PASSED COMPUTERS."
 110 PRINT "BRING A GIFT."
 120 PRINT "SUZIE"
 130 END

8-B READ and DATA Statements

1. 10 READ A,B,C
 20 LET D=A+B+C
 30 PRINT "THE SUM IS ";D
 40 DATA 3,7,10
 50 END

2. 10 READ A,B,C,D,E,F
 20 LET G=A+B
 30 LET H=C*D
 40 LET I=E/F
 50 PRINT A;" ";B;"=";G
 60 PRINT C;" TIMES ";D;"=";H
 70 PRINT E;" DIVIDED BY ";F;"=";I
 80 DATA 4,6,3,12,15,5
 90 END

3. 10 READ N\$,A\$
 20 PRINT N\$
 30 PRINT A\$
 40 DATA "EVA REAGAN","24 ELM STREET"
 50 END

8-C Loops using GOTO

1. 10 PRINT "OVER AND OVER AGAIN!"
 20 GOTO 10
 30 END

2. 10 PRINT "GO"
 20 PRINT "STOP"
 30 GOTO 10
 40 END

3. This program will print #1, then #2, then #3 over and over
 until the program is stopped.

4. 10 PRINT "#1"
 20 PRINT "#2"
 30 PRINT "#3"
 40 GOTO 30
 50 END

8-D Loops using FOR and NEXT

1. 10 FOR D=423 TO 511
 20 PRINT D
 30 NEXT D
 40 END

2. 10 FOR M=7 TO 700 STEP 7
 20 PRINT M
 30 NEXT M
 40 END
3. 10 FOR Z=1 TO 13
 20 PRINT "THIRTEEN IS A LUCKY NUMBER."
 30 NEXT Z
 40 END
4. 10 FOR B=20 TO 0 STEP -1
 20 PRINT B
 30 NEXT B
 40 PRINT "BLASTOFF!"
 50 END

QUIZ FOR PROGRAMMING - EIGHTH GRADE

At the completion of the eighth grade unit, students should be able to pass this quiz.

1. When you want to input a word into a program you must use an _____ variable.
2. The line:
10 LET A\$=PAUL
is incorrect unless PAUL is enclosed in _____.
3. Which line is correct?
1 10 LET G=TOM
2 20 LET E\$=EDGAR
3 30 LET F\$="FRAN" _____
4. Which line is correct?
1 10 LET G="10"
2 20 LET G\$="10"
3 30 LET G\$=10 _____
5. T or F. You may use a variable like P to save a phone number like 756-6267. _____
6. To input information to the computer you may use _____ and DATA statements.
7. T or F. Words like JOHN may not be input by READ and DATA statements. _____
8. T or F. The following program is correct:
10 READ A,B,C,D
20 PRINT A;B;C;D
30 DATA 56,87,42
40 END _____
9. What will be the output of this program?
10 READ A,B,C
20 PRINT A*C
30 DATA 3,6,9,10
40 END _____
10. How many DATA statements must there be if there is two READ statements? _____
11. When the computer does something over and over again, it is called a _____.
12. A _____ statement is used to tell the computer to go directly to a specified line.

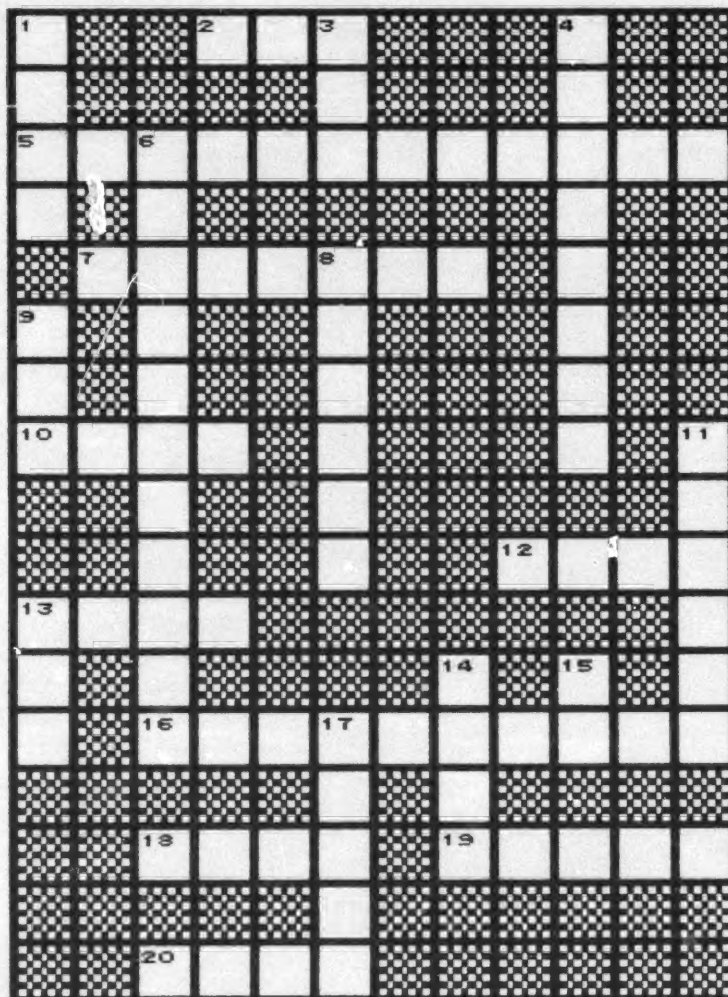
13. T or F. The following program will print 'HI THERE!' ten times:
 10 PRINT "HI THERE!"
 20 GOTO 10
 30 END _____
14. T or F. The following program will print 'RIGHT' and 'LEFT' on separate lines over and over until stopped:
 10 PRINT "RIGHT"
 20 PRINT "LEFT"
 30 GOTO 10
 40 END _____
15. One way to print a message more than one time is to use FOR and _____ statements.
16. Fill in the missing piece to this program:
 10 FOR E=1 _____ 20
 20 PRINT E
 30 NEXT E
 40 END
17. The word _____ will allow you to skip numbers in FOR and NEXT statements.
18. The below program will print the multiples of _____ from 24 to 792 inclusive:
 10 FOR C=24 TO 793 STEP 8
 20 PRINT C
 30 NEXT C
 40 END
19. T or F. The number following the word STEP may be negative.

20. T or F. The variable after the FOR can be different from the variable after the NEXT. _____

ANSWERS

- | | | |
|-----------------|----------|-----------|
| 1. alphanumeric | 8. F | 15. NEXT |
| 2. quotes | 9. 27 | 16. To |
| 3. 3 | 10. one | 17. STEP |
| 4. 2 | 11. loop | 18. eight |
| 5. F | 12. GOTO | 19. T |
| 6. READ | 13. F | 20. F |
| 7. F | 14. T | |

GRAMMING



ACROSS CLUES

2. Statement used with NEXT.
5. Variable that stores letters.
7. Series of instructions.
10. Used with READ statements.
12. Sends computer to a specific line.
13. Used to display the typed program.
16. Used to separate variables in a PRINT statement.
18. Used to skip numbers in FOR statements.
19. Used to display a message.
20. Used with FOR statements.

DOWN CLUES

1. Used with DATA statements.
3. Command to execute program.
4. Letter that stands for a number.
6. Computers always work inside these first.
8. Key to hit after each line.
9. Statement on the last line of most programs.
11. Messages must be enclosed in these to be printed.
13. Statement used to assign numbers to variables.
14. Something done over and over.
15. Word used in FOR statements.
17. Statement used to allow operator to type in data.

PROGRAMMING

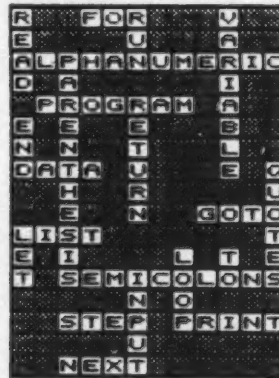
A L R O T O G U B F W P Q E
 S S I N P U T P P U P E P L
 P E B K K B X M M A U R N B
 T T T S J G D R R T O R A A
 N O L O C I M E S G U S M I
 D U D A T A N I R T I W M R
 E Q N E X T L A E B E L O A
 E N D F H K M R M W I P C V
 C I R E M U N A H P L A R I
 C T S W P R I N T A O E U M
 N I E H P H Z O U A A O N Q
 S C A L Z D X I I D S A L L
 N P K X A G F O D V K Q B K
 T V Z B J A M B F T U X E A

THERE ARE 20 WORDS HERE - CAN YOU FIND THEM?

HERE ARE THE WORDS TO LOOK FOR:

ALPHANUMERIC	COMMA
DATA	END
GOTO	INPUT
LET	LIST
LOOP	NEXT
PARENTHESIS	PRINT
PROGRAM	QUOTES
READ	RETURN
RUN	SEMICOLON
STEP	VARIABLE

ANSWERS: PROGRAMMING



PROGRAMMING

```

      O T O G      E
S I N P U T      P P L
E      A R N E
T      P R O G R A M
N O L O C I M E S O U M I
U D A T A N I R L M R
O N E X T L A E E O A
E N D H M R P C U
C I R E M U N A H P L A R
T S P R I N T O C U
I E A O N
E L D L

```